



**Evergreen Resources Management**  
2 Righter Parkway, Suite 200  
Wilmington, DE 19803

January 30, 2014

Mr. Steve O'Neil  
Pennsylvania Department of Environmental Protection  
2 East Main Street  
Norristown, Pennsylvania 19401

**RE: Philadelphia Refinery Remediation Program  
Remediation Status Report, Fourth Quarter 2013**

Dear Mr. O'Neil:

Enclosed for your review is a quarterly summary report for Operation & Maintenance (O&M) work completed at the Philadelphia Energy Solutions Refining & Marketing LLC (PES) Philadelphia Refinery and the Sunoco Logistics Belmont Terminal between October 1 and December 31, 2013. Detailed information regarding O&M activity is included in the attached tables and figures for the Philadelphia Refinery as prepared by Stantec Consulting Services Inc. (Stantec). Figure 1 is a site location map showing the facility location with respect to the surrounding area, and Figure 2 is a site plan which identifies remediation system areas. This letter summarizes the information detailed in the tables plus additional activities under the Consent Order & Agreement (CO&A) such as investigations of the various Areas of Interest (AOIs).

In compliance with the 2003 CO&A entered into between Sunoco Inc., (R&M) (Sunoco) and the Pennsylvania Department of Environmental Protection (PADEP) for the Philadelphia Refinery property located at 3144 Passyunk Avenue in Philadelphia, Pennsylvania, Sunoco has completed site characterization activities for all 11 AOIs. This facility has since been entered into the Pennsylvania One Cleanup Program. On November 30, 2011, Sunoco submitted a "Work Plan for Site Wide Approach under the One Cleanup Program" (Site Wide Approach) to the PADEP and the United States Environmental Protection Agency (USEPA). The Site Wide Approach clarifies the technical approach outlined in the CO&A and provides an anticipated schedule for future Act 2 submissions with respect to the Philadelphia Refinery remediation program. Effective December 30, 2013, "Philadelphia Refinery Operations, a series of Evergreen Resources Group, LLC" (Evergreen) assumed Sunoco/Atlantic's legacy remediation liabilities with respect to the Philadelphia Refinery. All remediation of Sunoco/Atlantic's historic environmental liabilities at the Philadelphia Refinery will be managed moving forward by Evergreen. Site Characterization Reports submitted to the agencies will be repackaged into Site Characterization/Remedial Investigation Reports (SCR/RIR). Status and anticipated dates of submittals will be updated in the quarterly Remediation Status Reports. This particular status report will not include an updated schedule for submittals under Act 2. Evergreen is currently working with David Brown, PADEP, to develop an approach for more acceptable submittals of Act 2 reports. We expect to have an updated schedule in the next quarterly status report.

As the Department is aware, on September 8, 2012, Sunoco conveyed the Philadelphia Refinery to PES. As part of that transaction, Sunoco retained responsibility for remediation activities for environmental conditions existing at

the time of the transfer. Accordingly, Evergreen will continue to submit the required documentation and implement the required remedial obligations.

### **AOI 1 – Belmont Terminal / No. 1 Tank Farm / No. 2 Tank Farm**

#### **Consent Order / Characterization Status**

Sunoco submitted to the PADEP and the USEPA a Site Characterization Report (SCR) for AOI 1 dated June 30, 2005. Based on comments received by the PADEP with regard to the AOI 1 SCR, Sunoco prepared and submitted to PADEP a revised SCR for AOI 1 dated July 17, 2006. The recommendations in the AOI 1 report were to supplement the existing remediation system along the northwestern portion of the Belmont Terminal and southeastern portion of the No. 1 Tank Farm. Sunoco has implemented these actions as detailed in previous quarterly reports. In addition, Sunoco provided the PADEP a Remedial Action Plan (RAP) for AOI 1 in January 2008. As a result of the 26<sup>th</sup> Street North remediation system study and the S-50 Area investigation, an addendum to the RAP was considered necessary. In December 2008, a RAP Addendum for AOI 1 was submitted to address the 26<sup>th</sup> Street North recovery system data analysis and the S-50 Area (26<sup>th</sup> Street South) investigation and subsequent remedial actions.

#### **Belmont Terminal – Operation During the Quarter**

On June 5, 2013, the Loading Rack System was turned off and will remain off in order to maximize recovery in the 26<sup>th</sup> Street North area. The Loading Rack System will be restarted pending modifications to the 26<sup>th</sup> Street North recovery system which is expected to begin in 2014.

On August 30, 2012, the Frontage Road System was turned off and will remain offline unless there are significant increases in light non-aqueous phase liquid (LNAPL) in the recovery wells. The wells were gauged on October 18, 2013 and no product was detected in the recovery wells.

#### **Shunk Street Sewer Ventilation System and Biofilter – Operation During the Quarter**

The biofilter was operational for the reporting period. System data for the quarter can be found in Attachment 1.

#### **26th Street Sewer Area – Operation During the Quarter**

Due to high iron content of the total fluids recovered, the pumps routinely become fouled. During weekly visits, pumps were pulled, cleaned, and redeployed as needed. Similarly, the system flow meter also fouls with iron; therefore, actual gallons recovered may be greater than recorded for some weekly visits. The system was operational for the reporting period with the following exceptions. The system was down on October 4 due to high oil temperature on the compressor. A new temperature sensor was installed on November 6, and the compressor was restarted; however, the compressor shut off shortly thereafter. On November 19, the compressor's internal thermostat was replaced and the system was restarted. On November 25, the compressor was down due to a loose high pressure oil line and numerous pumps were frozen. The flow meter was inoperable on December 9. On December 18, the system was down as PES electricians temporarily cut power to work at the substation. The system was down on December 23, and the flow meter was inoperable.

A total of 1,851,470 gallons of total fluids was recovered by the 26<sup>th</sup> Street recovery system. System recovery totals for the quarter can be found in Attachment 1.

26th Street Sewer Area – System Performance

26<sup>th</sup> Street North:

Sunoco has conducted a performance assessment of this system to better determine the effectiveness of remediation in this area. In general, Sunoco believes that the reporting of groundwater and LNAPL recovery provides limited indication of system performance, and should be supplemented with measurements related to maintaining groundwater level and affecting a gradient towards collection points.

It was concluded in the AOI 1 RAP Addendum that the extent of LNAPL has not changed significantly; however, LNAPL thickness appears to have decreased over time, indicating stability of LNAPL along the 26<sup>th</sup> Street North area.

26<sup>th</sup> Street South (S-50 Area):

A comprehensive groundwater investigation was conducted in the 26<sup>th</sup> Street South area. This data and proposed remedial action was included in the AOI 1 RAP Addendum. To minimize the migration of soluble phase contaminants, a biologically active aerobic barrier utilizing oxygen injection was recommended for the area. A thirty-point O<sub>2</sub> injection system was installed to accomplish this barrier. Operational and performance data is collected in accordance with the performance monitoring plan and is included in Attachment 2.

26th Street Biofilter – Operation During the Quarter

The biofilter was operational throughout the quarter. The system operation is checked once per week and includes the collection of influent and effluent vapor concentrations utilizing a photoionization detector (PID). System data for the quarter can be found in Attachment 1.

**AOI 2 – Point Breeze Processing Area**

Consent Order / Characterization Status

The AOI 2 SCR/RIR was submitted to the PADEP and the USEPA on September 29, 2010.

Pollock Street Sewer Area – Operation During Quarter

During October 2011, heavier than usual quantities of oil were observed within the Pollock Street sewer outfall. As a result, Sunoco completed the expansion of the existing vertical recovery well remediation system in the vicinity of the Pollock Street sewer outfall in February 2012. The system, referred to as the Pollock Street West End System, consists of a total of ten 4-inch diameter recovery wells on the east side of River Road and twenty 6-inch diameter recovery wells on the west side of River Road. Groundwater and LNAPL are removed from select recovery wells using pneumatic submersible pumps. All liquids are processed through an oil/water separator. Water is discharged to a refinery process sewer, and LNAPL is recovered in a series of two 550-gallon tanks and then recycled by the refinery. A report describing the details of the investigation and remediation performed in response to the oil observed in the Pollock Street outfall was submitted to the PADEP and the USEPA on June 29, 2012.

The Pollock Street West End System was operational throughout the quarter with the exception of minor maintenance. A total of 3,011,170 gallons of groundwater and 3,375 gallons of LNAPL were recovered by this system in the quarter.

The Pollock Street Vertical Well System consists of RW-101, RW-102, and RW-103. All other vertical wells were previously turned off or incorporated into the Pollock Street West End System. On April 4, the vertical recovery wells were turned off for main discharge line cleaning and the installation of a new pump at horizontal well HW-1. HW-1 maintained adequate drawdown; therefore, the Pollock Street Vertical Well System was not needed. The recovery equipment was removed from RW-101, RW-102 and RW-103 on August 2, 2013.

Horizontal wells HW-1, HW-2, and HW-3 were operational for the reporting period with the following exceptions. On October 30, HW-2 was down due to a clog in the main line. HW-1 and HW-2 were shut down on November 5 and November 6 for quarterly maintenance. On November 18, HW-2 was shut down due to a blown diaphragm. The pump was rebuilt, reinstalled and restarted on November 21.

The flow rates for the Pollock Street Horizontal Well Recovery System are estimated to be as follows:

- HW-1: 10 gallons per minute (gpm)
- HW-2: 3.7 gpm
- HW-3: 15.4 gpm

Beginning May 25, 2013, HW-1 flow rates are measured and reported by totalizer. A total of 3,255,580 gallons of total fluids were recovered by the Pollock Street Horizontal Well Recovery System. System recovery totals for the quarter can be found in Attachment 1.

The Pollock Street Sewer outfall is checked by PES personnel and all findings are recorded. This practice will continue and any LNAPL will be handled with spill control equipment to minimize or prevent releases to the Schuylkill River. Evergreen has continued to maintain boom and sorbent sweeps around the tide gate area. Outfall cleaning, including the changing of sorbents and removal of any fugitive LNAPL from the outfall, occurs a minimum of twice per week. The skimmer discharge was tied into the Pollock Street West End System treatment trailer during construction of the Pollock Street West End System.

The outfall skimmer was operational throughout this reporting period with the following exceptions. On November 13, the skimmer was down due to a broken belt and damaged gear; the belt was replaced, the gear was repaired and the skimmer was restarted. The skimmer was inoperable on November 26 due to a broken belt and malfunctioning internal heater; the belt was replaced; however, the skimmer remained off until the heater could be repaired. On December 2, the skimmer was restarted. On December 11, the skimmer was down at the morning visit, maintenance was performed, and the skimmer was returned to service. The skimmer was inoperable on December 19. A new transformer was installed in the control box and the skimmer was restarted on December 24.

#### Short Pier – Operation During the Quarter

There was no evidence of LNAPL migration to the river during the reporting period. Unless evidence of LNAPL migration to the river occurs, the system will remain offline.

#### AOI 3 – Impoundment Area

There are no groundwater or LNAPL recovery systems active in this area. The AOI 3 SCR/RIR was submitted to the PADEP and the USEPA on September 27, 2010. The SCR/RIR stated that given the limited occurrence and mobility of LNAPL observed in RW-2, the recovery system will remain offline. The disposition of remediation systems in AOI 3 will be revisited in the Cleanup Plan.

#### **AOI 4 – No. 4 Tank Farm Area**

##### **Consent Order / Characterization Status**

AOI 1 and AOI 4 were identified by Sunoco as the first areas of the refinery to be investigated in accordance with the Phase II Corrective Action Schedule included in the Current Conditions Report (CCR). Sunoco submitted to the PADEP and the USEPA a SCR for AOI 4 dated August 30, 2006. A repackaged SCR/RIR was submitted to the agencies on October 18, 2013. A “Disapproval of Remedial Investigation Report” was received from PADEP on January 15, 2014.

##### **Penrose Avenue – Operation During the Quarter**

Following characterization of AOI 4, Sunoco recommended the installation of a hydraulic control system on the southern border of AOI 4. This system is permitted for discharge by the Philadelphia Water Department (PWD) and Philadelphia Air Management Services (AMS). The installation of the remediation system was completed in December 2012 and following minor modifications to the system to facilitate water discharge monitoring in accordance with the PWD permit, the system was started on March 20, 2013.

The system was operational for the reporting period with the following exceptions. The system was down on high oil/water separator alarm on October 10 and October 11. The pumps in recovery wells RW-705 through RW-717 were shut down on October 11. Plant air was down on October 16. The air was restored on October 17 and the system was restarted.

A total of 913,000 gallons of groundwater and one gallon of LNAPL were recovered by this system during the reporting period. Groundwater and product recovery totals for the quarter can be found in Attachment 1.

##### **S-30 and S-36 LNAPL Recovery Systems – Operation During the Quarter**

Due to the absence of recoverable product in the recovery wells, Evergreen recommends that S-30, S-34, S-35, and S-36 remain offline.

#### **AOI 5 – Girard Point South Tank Field**

##### **Consent Order / Characterization Status**

In accordance with the Site Wide Approach, a repackaged Site Characterization Report/Remedial Investigation Report/Cleanup Plan (SCR/RIR/Cleanup Plan) was submitted to the PADEP and the USEPA on December 13, 2011. Sunoco received a “Remedial Investigation Report/Cleanup Plan Disapproval from the PADEP on March 15, 2012.

#### **AOI 6 – Girard Point Chemicals Processing Area**

##### **Consent Order / Characterization Status**

AOI 6 was identified by Sunoco as the third area of the refinery to be investigated in accordance with the Phase II Corrective Action Schedule included in the CCR. A SCR for AOI 6 was submitted to the PADEP and the USEPA on September 29, 2006. A repackaged SCR/RIR was submitted to the agencies on September 2, 2013.

**27 Pump House – Operation During the Quarter**

The system was turned off September 20, 2010 due to absence of recoverable product. Recovery wells B-124, B-132, B-137, B-139, B-142, B-143, and B-147 contain absorbent socks. On April 10, socks were removed from B-132, B-137, B-139, and B-147 due to lack of product. Absorbent socks remain only in recovery wells B-124, B-142, and B-143. During the reporting period, wells were routinely gauged and the absorbent socks were replaced when necessary. LNAPL recovery volumes are recorded using a graduated beaker and recovered product is transferred to the system holding tank. Passive remediation will continue until no measurable product is observed or until recoverable thicknesses of LNAPL return to the recovery wells.

Approximately six gallons of LNAPL were recovered using the above referenced methods. Recovery totals for the quarter can be found in Attachment 1.

**AOI 7 – Girard Point Fuels Processing Area**

**Consent Order / Characterization Status**

In accordance with the Site Wide Approach, a repackaged AOI 7 SCR/RIR was submitted to the PADEP and the USEPA on February 29, 2012. A RIR Addendum was submitted to the agencies on September 16, 2013.

**No. 3 Separator / Bulkhead Area**

On July 12, 2011, Sunoco reported a hydrocarbon sheen on the Schuylkill River to the National Response Center. The sheen was directly adjacent to the Girard Point No. 3 Separator. In response to the sheen on the river, Sunoco investigated the source of hydrocarbons to the river through the installation of monitoring wells and exploratory excavation around a process sewer junction box associated with the 137 Crude Unit and the No. 3 Separator. The monitoring wells demonstrated measurable oil on the water table, and the exploratory excavation revealed integrity issues with the junction box. The junction box and associated bulkhead penetration were sealed with concrete.

Construction of a ten recovery well hydraulic control system was completed on August 23, 2012. Groundwater and LNAPL are extracted using pneumatic submersible pumps, and total fluids pass through an oil/water separator. Water is discharged to an onsite process sewer, and LNAPL is recovered in a tank and recycled by the refinery.

On March 19, 2013, the remediation system was shut down due to high level in the recovery tank. The tank was evacuated, and the system was restarted. Due to an increase in product recovery, the tank was placed on a more frequent evacuation schedule. The system recovery wells and performance monitoring wells were gauged. Well gauging demonstrated an increased thickness of oil in the recovery wells and performance monitoring wells. No oil was observed in the river. A release was verbally communicated by PES to Andrew Sinclair of the PADEP on March 28, 2013. PES initiated an investigation of the adjacent process sewer line which revealed breaches in the sewer line adjacent to a junction box. The PES investigation/repair was completed in April 2013. Any questions regarding the investigation or repair of the sewer should be directed to Chuck Barksdale at [charles.barksdale@pes-companies.com](mailto:charles.barksdale@pes-companies.com).

A new oil/water separator was installed on July 3, and the system was restarted. The system was operational for the quarter with the exception of minor maintenance. On October 8, the system was shut off due to

breakthrough on the vapor phase carbon system. New carbon drums were installed and the system was restarted on October 16.

A total of 1,028,600 gallons of groundwater and 5,144 gallons of LNAPL were recovered by this system during the quarter. Groundwater and product recovery for the reporting period can be found in Attachment 1.

#### **AOI 8 – Point Breeze North Yard**

##### **Consent Order / Characterization Status**

A repackaged SCR/RIR incorporating the PADEP's comments on AOI 8 was submitted to the PADEP and the USEPA on January 31, 2012.

##### **PGW Border Recovery System – Operation During the Quarter**

The PGW Total Fluids Recovery System is offline. The system is being evaluated for potential upgrade.

##### **Jackson Street Sewer Area – Operation During the Quarter**

The Jackson Street Sewer Total Fluids Recovery System is offline. Due to limited LNAPL presence in the area, the system will remain off unless there are significant increases in LNAPL in the proximal wells. The Jackson Street combined sewer overflow outfall ("CSO") is checked once per shift by PES refinery personnel for a sheen or the presence of LNAPL. There has been no evidence of sheening to the river throughout the quarter.

##### **Jackson Street Sewer Water Curtain – Operation During the Quarter**

The Jackson Street Water Curtain was operational during the quarter. Due to reliability issues, the flow meter for the water curtain was taken out of service. Water flow rate is irrelevant to system operation. System data for the quarter is included in Attachment 1.

Sunoco agreed at the July 30, 2009 meeting to sample the air in the sewer onsite and offsite following notification from the PADEP of a neighborhood (28<sup>th</sup> and McKean Streets) complaint. No complaints regarding sewer odors were received during this quarter. Evergreen recommends that operation of the water curtain be discontinued.

##### **North Yard Bulkhead Area and No. 3 Tank Farm Separator – Operation During the Quarter**

The system was taken offline due to limited LNAPL presence in the area. The system will remain off unless there are significant increases in LNAPL in the proximal wells.

#### **AOI 9 – Schuylkill River Tank Farm**

There are no groundwater or LNAPL recovery systems operational in the area. A SCR was submitted to the PADEP and the USEPA on October 30, 2009.

#### **AOI 10 – West Yard**

There are no groundwater or LNAPL recovery systems operational in the area. A SCR/RIR was submitted to the PADEP and the USEPA on June 29, 2011. Approval of the RIR was received from PADEP on January 6, 2012.

### **AOI 11 – Deep Aquifer**

The SCR/RIR was submitted to the PADEP and the USEPA on September 12, 2011. Sunoco received comments to the report by email on December 9, 2011. The Final Report was submitted to the agencies on June 21, 2013. Sunoco received a “Disapproval of Final Report” from the PADEP dated September 26, 2013.

### **Passyunk Avenue Sewer**

The Passyunk Avenue Sewer CSO is checked by PES personnel once per shift at low tide and findings are recorded. LNAPL was not observed at the Schuylkill River outfall during the quarter.

### **Groundwater Monitoring**

The current monitoring program consists of quarterly groundwater and LNAPL gauging of select wells, annual groundwater and LNAPL gauging of site-wide wells, and annual groundwater sampling of select perimeter monitoring wells. During the first, third and fourth quarters, select wells are gauged to monitor LNAPL thickness and determine hydraulic effects of targeted recovery systems. The site-wide annual well gauging event is typically conducted during the second quarter of each year with results used to identify the presence of LNAPL and determine groundwater flow patterns. Liquid level measurements collected during the fourth quarter of 2013 are provided in Table 1.

The purpose of the annual groundwater sampling event is to evaluate concentration trends at the perimeter of the refinery. The annual groundwater sampling program consists of sampling select wells throughout the Point Breeze and Girard Point Processing Areas and has historically been performed during the fourth quarter of each year. However, this year and in future years, annual perimeter groundwater sampling will be performed in the second quarter in conjunction with annual site-wide gauging. The annual site-wide groundwater sampling event was conducted in April 2013.

Please contact me at (302) 477-0192 or [jroppenheim@evergreenresmgt.com](mailto:jroppenheim@evergreenresmgt.com) with any questions or comments.

Best Regards,



James Oppenheim, PE  
Senior Environmental Consultant

Enclosures (electronic):

- Figure 1 – Site Location Map
- Figure 2 – Remediation System Areas Site Plan
- Table 1 – Fourth Quarter 2013 Gauging Event
- Attachment 1 – Remediation System Recovery Total Data
- Attachment 2 – 26<sup>th</sup> Street South (S-50 Area) Report

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File: Remediation Status Report  
Philadelphia Refinery, 4<sup>th</sup> Quarter 2013

# **TABLE**

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 1	MW-26	10/18/2013	21.75	23.20	1.45	Shallow	No	Static	
AOI 1	MW-27	10/18/2013	23.85	24.07	0.22	Shallow	No	Static	
AOI 1	MW-28	10/18/2013	---	24.16	---	Intermediate	No	Static	
AOI 1	MW-29	10/18/2013	23.90	26.10	2.20	Intermediate	No	Static	
AOI 1	MW-30	10/18/2013	---	27.28	---	Shallow	No	Static	
AOI 1	MW-31	10/18/2013	---	25.65	---	Shallow	No	Static	
AOI 1	MW-32	10/18/2013	---	24.83	---	Intermediate	No	Static	
AOI 1	MW-33	10/18/2013	---	25.77	---	Shallow	No	Static	
AOI 1	MW-35	10/18/2013	---	26.65	---	Intermediate	No	Static	
AOI 1	MW-36	10/18/2013	---	27.63	---	Intermediate	No	Static	
AOI 1	MW-37	10/18/2013	---	26.78	---	Intermediate	No	Static	
AOI 1	MW-38	10/18/2013	---	22.92	---	Intermediate	No	Static	
AOI 1	MW-39	10/18/2013	---	22.78	---	Intermediate	No	Static	
AOI 1	MW-40	10/18/2013	23.09	23.43	0.24	Intermediate	No	Static	
AOI 1	MW-41	10/18/2013	---	22.59	---	Intermediate	No	Static	
AOI 1	MW-43	10/18/2013	---	26.18	---	Intermediate	No	Static	
AOI 1	MW-44	10/18/2013	---	25.31	---	Intermediate	No	Static	
AOI 1	OW-2	10/18/2013	---	26.71	---	Shallow	No	Static	
AOI 1	OW-12	10/18/2013	---	25.40	---	Shallow	No	Static	
AOI 1	OW-13	10/18/2013	---	27.28	---	Shallow	No	Static	
AOI 1	OW-14	10/18/2013	---	27.39	---	Shallow	No	Static	
AOI 1	OW-16	10/18/2013	26.48	26.92	0.44	Shallow	No	Static	
AOI 1	OW-17	10/18/2013	---	25.72	---	Shallow	No	Static	
AOI 1	OW-18	10/18/2013	---	26.82	---	Intermediate	No	Static	
AOI 1	OW-19	10/18/2013	NA	NA	NA	Intermediate	No	Static	Not accessible - vehicle parked on top of well
AOI 1	OW-20	10/18/2013	---	26.84	---	Shallow	No	Static	
AOI 1	PZ-400	10/18/2013	---	23.37	---	Shallow	No	Static	
AOI 1	PZ-401	10/18/2013	19.24	19.25	0.01	Shallow	No	Static	
AOI 1	PZ-402	10/18/2013	19.13	19.25	0.12	Shallow	No	Static	
AOI 1	PZ-403	10/18/2013	22.67	22.67	<0.01	Shallow	No	Static	
AOI 1	PZ-404	10/18/2013	26.07	26.65	0.58	Shallow	No	Static	
AOI 1	RW-1	10/18/2013	---	24.95	---	Intermediate	Yes	Static	
AOI 1	RW-4	10/18/2013	23.68	32.70	9.02	Intermediate	Yes	Static	
AOI 1	RW-6	10/18/2013	---	26.22	---	Intermediate	Yes	Static	
AOI 1	RW-7	10/18/2013	---	23.36	---	Intermediate	Yes	Static	
AOI 1	RW-15	10/18/2013	---	26.47	---	Intermediate	Yes	Static	
AOI 1	RW-21	10/18/2013	---	24.05	---	Shallow	Yes	Static	
AOI 1	RW-22	10/18/2013	---	22.20	---	Shallow	Yes	Static	
AOI 1	RW-23	10/18/2013	22.07	22.90	0.83	Intermediate	Yes	Static	
AOI 1	RW-24	10/18/2013	22.45	22.45	<0.01	Intermediate	Yes	Static	
AOI 1	RW-25	10/18/2013	25.18	26.21	1.03	Intermediate	Yes	Static	
AOI 1	RW-26	10/18/2013	---	25.23	---	Intermediate	Yes	Static	
AOI 1	RW-27	10/18/2013	---	25.18	---	Intermediate	Yes	Static	
AOI 1	RW-28	10/18/2013	---	25.26	---	Intermediate	Yes	Static	
AOI 1	RW-29	10/18/2013	---	25.48	---	Intermediate	Yes	Static	
AOI 1	RW-30	10/18/2013	---	25.35	---	Intermediate	Yes	Static	
AOI 1	RW-31	10/18/2013	---	25.51	---	Intermediate	Yes	Static	
AOI 1	RW-32	10/18/2013	---	23.72	---	Intermediate	Yes	Static	
AOI 1	RW-110	10/17/2013	---	16.85	---	Shallow	Yes	Static	Formerly S-160; Pollock Street East End
AOI 1	RW-111	10/17/2013	---	16.83	---	Shallow	Yes	Static	Formerly S-172; Pollock Street East End

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 1	RW-112	10/17/2013	---	16.86	---	Shallow	Yes	Static	Formerly S-173; Pollock Street East End
AOI 1	RW-400	10/17/2013	---	23.48	---	Intermediate	Yes	Static	
AOI 1	RW-401	10/17/2013	20.05	20.73	0.68	Intermediate	Yes	Static	Formerly S-94
AOI 1	RW-402	10/17/2013	---	17.27	---	Intermediate	Yes	Static	
AOI 1	RW-403	10/17/2013	---	20.52	---	Intermediate	Yes	Static	Formerly S-90
AOI 1	RW-404	10/17/2013	---	22.04	---	Intermediate	Yes	Static	
AOI 1	RW-405	10/17/2013	24.32	24.32	<0.01	Intermediate	Yes	Static	
AOI 1	RW-406	10/17/2013	22.26	22.87	0.61	Intermediate	Yes	Static	
AOI 1	S-41	10/17/2013	---	25.50	---	Intermediate	No	Static	
AOI 1	S-42I	10/17/2013	---	25.03	---	Intermediate	No	Static	Formerly S-42D
AOI 1	S-43	10/17/2013	---	23.70	---	Intermediate	No	Static	
AOI 1	S-44	10/17/2013	---	25.32	---	Intermediate	No	Static	
AOI 1	S-45	10/17/2013	---	22.14	---	Intermediate	No	Static	
AOI 1	S-46	10/17/2013	---	21.56	---	Intermediate	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-46D	10/17/2013	---	14.55	---	Deep	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-47I	10/17/2013	---	21.20	---	Intermediate	No	Static	Formerly S-47D; Pollock Street sewer recovery well (vicinity)
AOI 1	S-50	10/17/2013	---	22.37	---	Shallow	No	Static	
AOI 1	S-51	10/17/2013	---	22.08	---	Shallow	No	Static	
AOI 1	S-52	10/17/2013	---	22.75	---	Intermediate	No	Static	
AOI 1	S-74	10/17/2013	---	25.35	---	Shallow	No	Static	
AOI 1	S-75	10/17/2013	---	26.48	---	Shallow	No	Static	
AOI 1	S-76	10/17/2013	26.42	26.84	0.42	Shallow	No	Static	
AOI 1	S-77	10/17/2013	13.09	13.60	0.51	Shallow	No	Static	
AOI 1	S-77P	10/17/2013	---	28.59	---	Shallow	No	Static	
AOI 1	S-78	10/17/2013	---	26.43	---	Intermediate	No	Static	
AOI 1	S-79	10/17/2013	23.08	23.47	0.39	Intermediate	No	Static	
AOI 1	S-79P	10/17/2013	---	25.85	---	Shallow	No	Static	
AOI 1	S-80	10/17/2013	---	27.46	---	Shallow	No	Static	
AOI 1	S-80D	10/17/2013	---	29.68	---	Deep	No	Static	
AOI 1	S-81	10/17/2013	---	20.82	---	Shallow	No	Static	
AOI 1	S-82	10/17/2013	22.48	22.51	0.03	Shallow	No	Static	
AOI 1	S-83	10/17/2013	18.83	19.54	0.71	Shallow	No	Static	
AOI 1	S-84P	10/17/2013	---	17.10	---	Shallow	No	Static	
AOI 1	S-85	10/17/2013	---	23.32	---	Shallow	No	Static	
AOI 1	S-86	10/17/2013	26.17	26.17	<0.01	Intermediate	No	Static	
AOI 1	S-87I	10/17/2013	---	24.70	---	Intermediate	No	Static	
AOI 1	S-88	10/17/2013	---	24.75	---	Intermediate	No	Static	
AOI 1	S-88A	10/17/2013	---	25.23	---	Shallow	No	Static	
AOI 1	S-89	10/17/2013	---	26.20	---	Intermediate	No	Static	
AOI 1	S-95	10/17/2013	---	22.06	---	Intermediate	No	Static	
AOI 1	S-98	10/17/2013	---	22.48	---	Intermediate	No	Static	
AOI 1	S-99	10/17/2013	---	24.79	---	Intermediate	No	Static	
AOI 1	S-100	10/17/2013	22.39	23.33	0.94	Intermediate	No	Static	
AOI 1	S-101	10/17/2013	---	47.07	---	Intermediate	No	Static	
AOI 1	S-116	10/17/2013	---	13.17	---	Shallow	No	Static	
AOI 1	S-117	10/17/2013	---	17.15	---	Shallow	No	Static	
AOI 1	S-118	10/17/2013	---	17.27	---	Shallow	No	Static	
AOI 1	S-125	10/17/2013	21.44	21.63	0.19	Shallow	No	Static	
AOI 1	S-126	10/17/2013	14.98	15.24	0.26	Shallow	No	Static	
AOI 1	S-127	10/17/2013	---	16.36	---	Shallow	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 1	S-162	10/17/2013	---	17.22	---	Shallow	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-164	10/17/2013	---	15.73	---	Shallow	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-179	10/17/2013	---	19.91	---	Intermediate	No	Static	
AOI 1	S-180	10/17/2013	---	20.14	---	Intermediate	Yes	Static	
AOI 1	S-181	10/17/2013	21.80	22.12	0.32	Intermediate	Yes	Static	
AOI 1	S-182	10/17/2013	---	21.46	---	Intermediate	Yes	Static	
AOI 1	S-183	10/17/2013	22.14	22.14	<0.01	Intermediate	Yes	Static	
AOI 1	S-184	10/17/2013	---	21.66	---	Intermediate	Yes	Static	
AOI 1	S-185	10/17/2013	---	22.69	---	Intermediate	Yes	Static	
AOI 1	S-186	10/17/2013	---	22.33	---	Intermediate	Yes	Static	
AOI 1	S-187	10/17/2013	---	23.24	---	Intermediate	Yes	Static	
AOI 1	S-188	10/17/2013	---	23.55	---	Intermediate	Yes	Static	
AOI 1	S-189	10/17/2013	---	24.77	---	Intermediate	Yes	Static	
AOI 1	S-190	10/17/2013	---	24.65	---	Intermediate	Yes	Static	
AOI 1	S-191	10/17/2013	---	24.25	---	Intermediate	Yes	Static	
AOI 1	S-192	10/17/2013	---	24.56	---	Intermediate	Yes	Static	
AOI 1	S-193	10/17/2013	---	23.30	---	Intermediate	No	Static	
AOI 1	S-194	10/17/2013	---	25.22	---	Shallow	Yes	Static	
AOI 1	S-196	10/17/2013	NM	NM	NM	Shallow	No	Static	Lost from recent CSX grading of area
AOI 1	S-198	10/17/2013	24.28	25.97	1.69	Intermediate	No	Static	
AOI 1	S-199	10/17/2013	24.35	25.25	0.90	Intermediate	No	Static	
AOI 1	S-200	10/17/2013	---	24.42	---	Intermediate	No	Static	
AOI 1	S-201	10/17/2013	23.12	23.54	0.42	Intermediate	No	Static	
AOI 1	S-202	10/17/2013	---	28.25	---	Intermediate	No	Static	
AOI 1	S-203	10/17/2013	27.65	28.16	0.51	Intermediate	No	Static	
AOI 1	S-205	10/17/2013	17.61	19.35	1.74	Intermediate	No	Static	
AOI 1	S-206	10/17/2013	---	27.45	---	Intermediate	No	Static	
AOI 1	S-207	10/17/2013	---	13.24	---	Intermediate	No	Static	
AOI 1	S-208	10/17/2013	---	19.37	---	Intermediate	No	Static	
AOI 1	S-209	10/17/2013	---	25.89	---	Intermediate	No	Static	
AOI 1	S-210	10/17/2013	23.59	23.73	0.14	Intermediate	No	Static	
AOI 1	S-211	10/17/2013	---	14.10	---	Intermediate	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-212	10/17/2013	---	17.41	---	Intermediate	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-213	10/17/2013	---	14.14	---	Intermediate	No	Static	Pollock Street sewer recovery well (vicinity)
AOI 1	S-214	10/17/2013	---	18.86	---	Intermediate	No	Static	
AOI 1	S-226	10/17/2013	---	21.70	---	Intermediate	No	Static	
AOI 1	S-227	10/17/2013	---	22.26	---	Intermediate	No	Static	
AOI 1	S-228	10/17/2013	---	21.58	---	Intermediate	No	Static	
AOI 1	S-230	10/17/2013	---	20.11	---	Intermediate	No	Static	
AOI 1	S-231	10/17/2013	---	19.88	---	Intermediate	No	Static	
AOI 1	S-232	10/17/2013	---	20.38	---	Intermediate	No	Static	
AOI 1	S-255	10/17/2013	---	22.50	---	Intermediate	No	Static	
AOI 1	S-256	10/17/2013	---	21.59	---	Intermediate	No	Static	
AOI 1	S-257	10/17/2013	---	23.25	---	Intermediate	No	Static	
AOI 1	S-258	10/17/2013	---	23.80	---	Intermediate	No	Static	
AOI 1	S-259	10/17/2013	---	24.27	---	Intermediate	No	Static	
AOI 1	S-260	10/17/2013	---	23.15	---	Intermediate	No	Static	
AOI 1	S-261	10/17/2013	---	23.13	---	Intermediate	No	Static	
AOI 1	S-262	10/17/2013	---	18.57	---	Intermediate	No	Static	
AOI 1	S-263	10/17/2013	---	16.04	---	Intermediate	No	Static	

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**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 1	S-264D	10/17/2013	---	25.87	---	Deep	No	Static	
AOI 1	S-265	10/17/2013	13.65	13.66	0.01	Intermediate	Yes	Static	
AOI 1	S-267	10/17/2013	NM	NM	NM	Intermediate	Yes	Static	Unable to locate under heavy vegetation
AOI 1	S-268	10/17/2013	---	26.47	---	Intermediate	No	Static	Formerly S-264; CSX well
AOI 1	S-269	10/17/2013	---	20.42	---	Intermediate	No	Static	
AOI 1	S-270	10/17/2013	---	21.49	---	Intermediate	No	Static	
AOI 1	S-271	10/17/2013	---	23.64	---	Intermediate	No	Static	
AOI 1	S-272	10/17/2013	---	23.38	---	Intermediate	No	Static	
AOI 1	S-273	10/17/2013	---	22.80	---	Intermediate	No	Static	
AOI 1	S-274	10/17/2013	---	22.49	---	Intermediate	No	Static	
AOI 1	S-275	10/17/2013	---	21.67	---	Intermediate	No	Static	
AOI 1	S-276	10/17/2013	21.68	22.47	0.79	Intermediate	No	Static	
AOI 1	S-277	10/17/2013	21.19	21.80	0.61	Intermediate	No	Static	
AOI 1	S-312	10/17/2013	---	5.95	---	Shallow/Intermediate	No	Static	
AOI 1	S-330	10/17/2013	---	25.34	---	Intermediate	No	Static	
AOI 1	S-331	10/17/2013	---	27.41	---	Intermediate	No	Static	
AOI 1	S-332	10/17/2013	---	26.02	---	Intermediate	No	Static	
AOI 1	ARCO-1	10/17/2013	---	26.40	---	Intermediate	No	Static	
AOI 1	ARCO-1D	10/17/2013	---	26.52	---	Deep	No	Static	
AOI 1	ARCO-2	10/17/2013	---	25.65	---	Intermediate	No	Static	
AOI 1	ARCO-3	10/17/2013	---	24.41	---	Intermediate	No	Static	
AOI 1	TW-3	10/18/2013	---	27.19	---	Shallow	No	Static	
AOI 1	TW-5	10/18/2013	---	27.01	---	Shallow	No	Static	
AOI 1	TW-8	10/18/2013	---	25.55	---	Shallow	No	Static	
AOI 1	TW-9	10/18/2013	---	27.22	---	Shallow	No	Static	
AOI 1	TW-10	10/18/2013	---	25.81	---	Shallow	No	Static	
AOI 1	TW-11	10/18/2013	---	27.67	---	Shallow	No	Static	
AOI 2	C-HEADER	10/17/2013	---	11.33	---	Shallow/Intermediate	No	Static	
AOI 2	PZ-100	10/17/2013	---	16.80	---	Shallow	No	Static	Casing damaged at ground surface
AOI 2	PZ-101	10/17/2013	---	13.99	---	Shallow	No	Static	
AOI 2	RIVER 1	10/17/2013	---	12.41	---	NA	No	Static	
AOI 2	RIVER 3	10/17/2013	---	11.84	---	NA	No	Static	
AOI 2	RW-100	10/17/2013	20.09	20.17	0.08	Shallow	Yes	Static	
AOI 2	RW-101	10/17/2013	17.88	19.33	1.45	Shallow	Yes	Pumping	Pollock St. Vertical System well was pumping during gauging
AOI 2	RW-102	10/17/2013	15.63	15.64	0.01	Shallow	Yes	Pumping	Pollock St. Vertical System well was pumping during gauging
AOI 2	RW-103	10/17/2013	17.51	18.45	0.94	Shallow	Yes	Pumping	Pollock St. Vertical System well was pumping during gauging
AOI 2	RW-104	10/17/2013	---	12.90	---	Shallow	Yes	Pumping	
AOI 2	RW-105	10/17/2013	---	14.40	---	Shallow	Yes	Pumping	
AOI 2	RW-106	10/17/2013	---	15.40	---	Shallow	Yes	Static	Pump found inoperable and therefore not pumping at time of gauging
AOI 2	RW-107	10/17/2013	---	12.32	---	Shallow	Yes	Static	
AOI 2	RW-108	10/17/2013	---	8.02	---	Shallow	Yes	Static	
AOI 2	RW-109	10/17/2013	---	8.56	---	Shallow	Yes	Static	
AOI 2	RW-113	10/17/2013	---	19.80	---	Shallow	Yes	Pumping	
AOI 2	RW-114	10/17/2013	---	19.90	---	Shallow	Yes	Pumping	
AOI 2	RW-115	10/17/2013	---	20.90	---	Shallow	Yes	Pumping	
AOI 2	RW-116	10/17/2013	---	24.05	---	Shallow	Yes	Pumping	
AOI 2	RW-117	10/17/2013	---	21.65	---	Shallow	Yes	Pumping	
AOI 2	RW-118	10/17/2013	---	18.33	---	Shallow	Yes	Pumping	
AOI 2	RW-119	10/17/2013	---	17.15	---	Shallow	Yes	Pumping	
AOI 2	RW-120	10/17/2013	16.99	18.51	1.52	Shallow	Yes	Static	No pump installed

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AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 2	RW-121	10/17/2013	---	25.50	---	Shallow/Intermediate	Yes	Pumping	
AOI 2	RW-122	10/17/2013	13.71	13.71	<0.01	Shallow	Yes	Static	No pump installed
AOI 2	RW-123	10/17/2013	---	18.60	---	Shallow	Yes	Static	No pump installed
AOI 2	RW-124	10/17/2013	---	21.40	---	Shallow	Yes	Pumping	
AOI 2	RW-125	10/17/2013	---	22.10	---	Shallow	Yes	Pumping	
AOI 2	RW-126	10/17/2013	---	20.95	---	Shallow	Yes	Pumping	
AOI 2	RW-127	10/17/2013	---	23.75	---	Shallow	Yes	Pumping	
AOI 2	RW-128	10/17/2013	---	19.90	---	Shallow	Yes	Pumping	
AOI 2	RW-129	10/17/2013	---	21.30	---	Shallow	Yes	Pumping	
AOI 2	RW-601	10/17/2013	---	9.50	---	Shallow/Intermediate	NA	NA	
AOI 2	RW-602	10/17/2013	5.81	5.82	0.01	Shallow/Intermediate	Yes	Static	
AOI 2	S-48	10/17/2013	---	20.11	---	Shallow/Intermediate	No	Static	
AOI 2	S-53	10/17/2013	19.09	19.39	0.30	Shallow	No	Static	
AOI 2	S-54	10/17/2013	21.86	22.05	0.19	Intermediate	No	Static	
AOI 2	S-61	10/17/2013	16.42	16.49	0.07	Shallow/Intermediate	No	Static	
AOI 2	S-62	10/17/2013	---	19.53	---	Intermediate	No	Static	
AOI 2	S-63	10/17/2013	21.80	21.92	0.12	Shallow	No	Static	
AOI 2	S-64	10/17/2013	10.77	11.00	0.23	Shallow/Intermediate	No	Static	
AOI 2	S-65	10/17/2013	11.50	11.51	0.01	Shallow/Intermediate	No	Static	
AOI 2	S-71	10/17/2013	---	20.73	---	Shallow/Intermediate	No	Static	
AOI 2	S-72	10/17/2013	26.53	26.66	0.13	Intermediate	No	Static	
AOI 2	S-72D	10/17/2013	---	32.38	---	Deep	No	Static	
AOI 2	S-91	10/17/2013	21.03	21.04	0.01	Intermediate	No	Static	
AOI 2	S-92	10/17/2013	11.58	11.65	0.07	Intermediate	No	Static	
AOI 2	S-93	10/17/2013	---	18.39	---	Intermediate	Yes	Static	
AOI 2	S-105	10/17/2013	---	10.38	---	Shallow	No	Static	
AOI 2	S-107	10/17/2013	9.45	12.09	2.64	Shallow/Intermediate	No	Static	
AOI 2	S-108	10/17/2013	6.89	6.92	0.03	Shallow/Intermediate	No	Static	
AOI 2	S-110	10/17/2013	15.45	15.48	0.03	Shallow/Intermediate	No	Static	
AOI 2	S-130	10/17/2013	---	19.80	---	Shallow/Intermediate	No	Static	
AOI 2	S-131	10/17/2013	15.81	17.07	1.26	Shallow	No	Static	
AOI 2	S-132	10/17/2013	---	18.97	---	Shallow/Intermediate	No	Static	
AOI 2	S-133	10/17/2013	---	19.04	---	Shallow/Intermediate	No	Static	
AOI 2	S-134	10/17/2013	---	20.80	---	Shallow/Intermediate	No	Static	
AOI 2	S-135	10/17/2013	23.55	23.91	0.36	Shallow	No	Static	
AOI 2	S-136	10/17/2013	---	18.55	---	Shallow/Intermediate	No	Static	
AOI 2	S-137	10/17/2013	---	18.83	---	Shallow/Intermediate	No	Static	
AOI 2	S-139	10/17/2013	---	19.59	---	Shallow/Intermediate	No	Static	
AOI 2	S-140	10/17/2013	---	20.12	---	Shallow/Intermediate	No	Static	
AOI 2	S-141	10/17/2013	20.40	20.95	0.55	Shallow/Intermediate	No	Static	
AOI 2	S-142	10/17/2013	18.41	18.48	0.07	Shallow	No	Static	
AOI 2	S-143	10/17/2013	---	20.01	---	Shallow/Intermediate	No	Static	
AOI 2	S-150	10/17/2013	17.75	17.88	0.13	Shallow/Intermediate	No	Static	
AOI 2	S-153	10/17/2013	---	9.90	---	Shallow/Intermediate	No	Static	
AOI 2	S-154	10/17/2013	---	10.86	---	Shallow/Intermediate	No	Static	
AOI 2	S-156	10/17/2013	18.77	18.78	0.01	Shallow	No	Static	
AOI 2	S-157	10/17/2013	17.31	18.52	1.21	Shallow/Intermediate	No	Static	
AOI 2	S-159	10/17/2013	---	16.74	---	Shallow/Intermediate	No	Static	
AOI 2	S-165	10/17/2013	---	17.09	---	Shallow/Intermediate	No	Static	
AOI 2	S-166	10/17/2013	---	16.65	---	Shallow/Intermediate	No	Static	

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AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 2	S-174	10/17/2013	10.79	12.84	2.05	Shallow	No	Static	
AOI 2	S-175	10/17/2013	18.18	19.20	1.02	Shallow	No	Static	
AOI 2	S-177	10/17/2013	---	18.46	---	Shallow/Intermediate	No	Static	
AOI 2	S-178	10/17/2013	---	16.50	---	Shallow/Intermediate	No	Static	
AOI 2	S-246A	10/17/2013	---	11.01	---	Shallow/Intermediate	No	Static	
AOI 2	S-247	10/17/2013	---	11.19	---	Shallow/Intermediate	No	Static	
AOI 2	S-248	10/17/2013	---	9.90	---	Shallow/Intermediate	No	Static	
AOI 2	S-249	10/17/2013	---	10.84	---	Shallow/Intermediate	No	Static	
AOI 2	S-251	10/17/2013	---	19.19	---	Shallow/Intermediate	No	Static	
AOI 2	S-252	10/17/2013	---	19.59	---	Shallow/Intermediate	No	Static	
AOI 2	S-253	10/17/2013	---	19.26	---	Shallow/Intermediate	No	Static	
AOI 2	S-254	10/17/2013	---	19.58	---	Shallow/Intermediate	No	Static	
AOI 2	S-292	10/17/2013	---	19.60	---	Shallow/Intermediate	No	Static	
AOI 2	S-294	10/17/2013	---	29.68	---	Intermediate	No	Static	
AOI 2	S-294D	10/17/2013	---	32.19	---	Deep	No	Static	
AOI 2	S-295	10/17/2013	---	23.86	---	Shallow/Intermediate	No	Static	
AOI 2	S-297	10/17/2013	26.13	27.08	0.95	Shallow/Intermediate	No	Static	
AOI 2	S-298	10/17/2013	18.24	18.29	0.05	Shallow/Intermediate	No	Static	
AOI 2	S-299	10/17/2013	---	21.17	---	Shallow/Intermediate	No	Static	
AOI 2	S-300	10/17/2013	---	21.45	---	Shallow/Intermediate	No	Static	
AOI 2	S-301	10/17/2013	---	16.97	---	Shallow/Intermediate	No	Static	
AOI 2	S-302	10/17/2013	22.01	22.48	0.47	Intermediate	No	Static	
AOI 2	S-302D	10/17/2013	---	24.49	---	Deep	No	Static	
AOI 2	S-303	10/17/2013	---	20.32	---	Shallow/Intermediate	No	Static	
AOI 2	S-304	10/17/2013	---	13.02	---	Shallow/Intermediate	No	Static	
AOI 2	S-305	10/17/2013	---	18.83	---	Intermediate	No	Static	
AOI 2	S-305D	10/17/2013	---	19.70	---	Deep	No	Static	
AOI 2	S-306	10/17/2013	---	24.46	---	Intermediate	No	Static	
AOI 2	S-307	10/17/2013	---	16.29	---	Shallow/Intermediate	No	Static	
AOI 2	S-308	10/17/2013	---	22.84	---	Shallow/Intermediate	No	Static	
AOI 2	S-309	10/17/2013	---	17.76	---	Shallow/Intermediate	No	Static	
AOI 2	S-310	10/17/2013	---	10.49	---	Shallow/Intermediate	No	Static	
AOI 2	S-311	10/17/2013	24.98	25.25	0.27	Intermediate	No	Static	
AOI 2	S-313	10/17/2013	---	22.70	---	Shallow	yes	Pumping	
AOI 2	S-314	10/17/2013	---	19.39	---	Shallow	No	Static	
AOI 2	S-315	10/17/2013	---	22.20	---	Shallow	yes	Pumping	
AOI 2	S-316	10/17/2013	---	18.50	---	Shallow	yes	Static	
AOI 2	S-317	10/17/2013	---	18.77	---	Shallow	No	Static	
AOI 2	S-318	10/17/2013	---	22.47	---	Shallow/Intermediate	No	Static	
AOI 2	S-328	10/17/2013	19.41	19.42	0.01	Shallow/Intermediate	No	Static	
AOI 2	S-333	10/17/2013	---	12.94	---	Shallow/Intermediate	No	Static	
AOI 2	S-335	10/17/2013	---	14.40	---	Shallow/Intermediate	No	Static	
AOI 2	S-336	10/17/2013	---	10.08	---	Shallow/Intermediate	No	Static	
AOI 2	S-337	10/17/2013	12.00	12.01	0.01	Shallow/Intermediate	No	Static	
AOI 2	S-338	10/17/2013	11.46	18.66	7.20	Shallow/Intermediate	No	Static	
AOI 2	S-346	10/17/2013	---	18.50	---	Shallow/Intermediate	No	Static	
AOI 2	S-347	10/17/2013	18.01	19.00	0.99	Shallow/Intermediate	No	Static	
AOI 2	S-348	10/17/2013	13.10	13.60	0.50	Shallow/Intermediate	No	Static	
AOI 2	S-349	10/17/2013	15.44	15.70	0.26	Shallow/Intermediate	No	Static	
AOI 2	S-350	10/17/2013	---	26.90	---	Shallow/Intermediate	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 2	S-351	10/17/2013	---	30.62	---	Shallow/Intermediate	No	Static	
AOI 2	S-354	10/17/2013	---	24.53	---	Shallow/Intermediate	No	Static	
AOI 2	S-355	10/17/2013	27.06	27.18	0.12	Shallow/Intermediate	No	Static	
AOI 2	S-357	10/17/2013	14.68	25.08	0.40	Shallow/Intermediate	No	Static	
AOI 2	S-359	10/17/2013	17.95	18.04	0.09	Shallow/Intermediate	No	Static	
AOI 2	S-360	10/17/2013	22.67	22.84	0.17	Shallow/Intermediate	No	Static	
AOI 2	S-361	10/17/2013	---	23.83	---	Shallow/Intermediate	No	Static	
AOI 2	S-362	10/17/2013	22.76	23.46	0.70	Shallow/Intermediate	No	Static	
AOI 2	S-363	10/17/2013	24.91	24.94	0.03	Shallow/Intermediate	No	Static	
AOI 2	S-382	10/17/2013	10.55	10.55	<0.01	Shallow/Intermediate	No	Static	Formerly Warehouse MW-2
AOI 2	SD-1	10/17/2013	---	8.26	---	Shallow	No	Static	
AOI 4	S-29	10/16/2013	20.18	23.41	3.23	Intermediate	No	Static	
AOI 4	S-30	10/16/2013	21.08	27.71	6.63	Intermediate	Yes	Static	
AOI 4	S-31	10/16/2013	18.10	19.04	0.94	Shallow	No	Static	
AOI 4	S-32	10/16/2013	23.02	23.17	0.15	Shallow	No	Static	
AOI 4	S-34	10/16/2013	---	20.15	---	Shallow	No	Static	
AOI 4	S-35	10/16/2013	---	20.21	---	Shallow	No	Static	
AOI 4	S-36	10/16/2013	---	23.33	---	Shallow	Yes	Static	
AOI 4	RW-700	10/16/2013	---	17.02	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-701	10/16/2013	---	17.23	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-702	10/16/2013	---	19.89	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-703	10/16/2013	---	19.63	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-704	10/16/2013	---	19.68	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-705	10/16/2013	---	14.88	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-706	10/16/2013	---	14.91	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-707	10/16/2013	---	15.24	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-708	10/16/2013	---	14.43	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-709	10/16/2013	---	14.25	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-710	10/16/2013	---	15.08	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-711	10/16/2013	---	14.48	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-712	10/16/2013	---	14.57	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-713	10/16/2013	---	14.00	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-714	10/16/2013	---	14.19	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-715	10/16/2013	---	14.31	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-716	10/16/2013	---	14.48	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 4	RW-717	10/16/2013	---	14.50	---	Intermediate	Yes	Static	System off due to maintenance on plant air line.
AOI 5	A-1	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-3	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-4	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-5	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-6	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-7	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-9	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-10	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-11	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-12	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-13	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-13D	10/16/2013	---	---	---	Deep	No	Static	
AOI 5	A-14	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-15	10/16/2013	---	---	---	Shallow	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 5	A-16	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-19D	10/16/2013	---	---	---	Deep	No	Static	
AOI 5	A-21	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-21D	10/16/2013	---	---	---	Deep	No	Static	
AOI 5	A-22	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-23	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-24	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-25	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-26	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-27	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-39	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-40	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-41	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-43	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-44	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-45	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-46	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-47	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-48	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-49	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-91	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-118	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-121	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-122	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-133	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-134	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-135	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-136	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-137	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-138	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-139	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-140	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-142	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-143	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-144	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-145	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-146	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-147	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-148	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-149	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-150	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-151	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-152	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-155	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-156	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-157	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-159	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-160	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-161	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	A-162	10/16/2013	---	---	---	Other	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 5	A-163	10/16/2013	---	---	---	Other	No	Static	
AOI 5	A-164	10/16/2013	---	---	---	Other	No	Static	
AOI 5	PZ-2	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	PZ-3	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	RW-6S	10/16/2013	---	---	---	Shallow	No	Static	
AOI 5	RWBH-1	10/16/2013	---	3.48	---	Shallow	Yes	Static	
AOI 5	RWBH-2	10/16/2013	---	2.68	---	Shallow	Yes	Static	
AOI 6	B-39	10/16/2013	---	1.51	---	Shallow	No	Static	
AOI 6	B-43	10/16/2013	4.45	4.47	0.02	Shallow	No	Static	
AOI 6	B-45	10/16/2013	---	1.03	---	Shallow	No	Static	
AOI 6	B-46	10/16/2013	---	1.50	---	Shallow	No	Static	
AOI 6	B-47	10/16/2013	3.36	3.36	<0.01	Shallow	No	Static	
AOI 6	B-48	10/16/2013	---	0.03	---	Shallow	No	Static	
AOI 6	B-48D	10/16/2013	---	11.64	---	Deep	No	Static	
AOI 6	B-92	10/16/2013	---	5.17	---	Shallow	No	Static	Clear perimeter
AOI 6	B-94	10/16/2013	---	7.16	---	Shallow	No	Static	
AOI 6	B-95	10/16/2013	---	5.00	---	Shallow	No	Static	
AOI 6	B-115	10/16/2013	---	3.47	---	Shallow	No	Static	
AOI 6	B-116	10/16/2013	---	6.17	---	Shallow	No	Static	
AOI 6	B-117	10/16/2013	---	8.38	---	Shallow	No	Static	
AOI 6	B-123	10/16/2013	---	4.84	---	Shallow	No	Static	Clear southeast perimeter
AOI 6	B-124	10/16/2013	---	4.83	---	Shallow	No	Static	
AOI 6	B-125	10/16/2013	---	5.06	---	Shallow	No	Static	
AOI 6	B-126	10/16/2013	---	5.18	---	Shallow	No	Static	
AOI 6	B-129	10/16/2013	5.19	10.57	5.38	Shallow	No	Static	
AOI 6	B-130	10/16/2013	5.22	5.45	0.23	Shallow	No	Static	
AOI 6	B-131	10/16/2013	---	4.93	---	Shallow	No	Static	
AOI 6	B-132	10/16/2013	---	4.47	---	Shallow	No	Static	
AOI 6	B-132D	10/16/2013	---	15.77	---	Deep	No	Static	
AOI 6	B-133	10/16/2013	---	5.04	---	Shallow	No	Static	
AOI 6	B-133D	10/16/2013	---	10.68	---	Deep	No	Static	
AOI 6	B-134	10/16/2013	---	4.72	---	Shallow	No	Static	
AOI 6	B-134D	10/16/2013	---	11.57	---	Deep	No	Static	
AOI 6	B-135	10/16/2013	---	4.79	---	Shallow	No	Static	
AOI 6	B-136	10/16/2013	4.65	4.66	0.01	Shallow	No	Static	
AOI 6	B-137	10/16/2013	4.24	4.66	0.42	Shallow	No	Static	
AOI 6	B-138	10/16/2013	4.25	4.26	0.01	Shallow	No	Static	
AOI 6	B-139	10/16/2013	5.51	5.57	0.06	Shallow	No	Static	
AOI 6	B-141	10/16/2013	---	4.03	---	Shallow	No	Static	
AOI 6	B-142	10/16/2013	7.18	7.18	<0.01	Shallow	Yes	Static	
AOI 6	B-143	10/16/2013	5.41	5.41	<0.01	Shallow	Yes	Static	
AOI 6	B-144	10/16/2013	---	4.85	---	Shallow	No	Static	
AOI 6	B-145	10/16/2013	---	4.33	---	Shallow	No	Static	
AOI 6	B-147	10/16/2013	6.04	6.05	0.01	Shallow	No	Static	
AOI 6	B-148	10/16/2013	5.28	5.76	0.48	Shallow	No	Static	
AOI 6	B-149	10/16/2013	---	3.31	---	Shallow	No	Static	
AOI 6	B-150	10/16/2013	3.06	6.17	3.11	Shallow	No	Static	
AOI 6	B-151	10/16/2013	---	3.69	---	Shallow	No	Static	
AOI 6	B-152	10/16/2013	---	1.46	---	Shallow	No	Static	
AOI 6	B-153	10/16/2013	---	2.01	---	Shallow	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 6	B-154	10/16/2013	---	3.16	---	Shallow	No	Static	
AOI 6	B-155	10/16/2013	---	4.89	---	Shallow	No	Static	
AOI 6	B-156	10/16/2013	---	5.82	---	Shallow	No	Static	
AOI 6	B-158	10/16/2013	---	3.21	---	Shallow	No	Static	
AOI 6	B-160	10/16/2013	---	4.37	---	Shallow	No	Static	
AOI 6	B-161	10/16/2013	4.32	4.60	0.28	Shallow	No	Static	
AOI 6	B-162	10/16/2013	NA	NA	NA	Shallow	No	Static	Not accessible - area around well was flooded
AOI 6	B-163	10/16/2013	---	1.56	---	Shallow	No	Static	
AOI 6	B-164	10/16/2013	---	5.04	---	Shallow	No	Static	
AOI 6	B-165	10/16/2013	---	2.67	---	Shallow	No	Static	
AOI 6	B-166	10/16/2013	---	3.17	---	Shallow	No	Static	
AOI 6	B-167	10/16/2013	---	3.28	---	Shallow	No	Static	
AOI 6	B-168	10/16/2013	---	2.26	---	Shallow	No	Static	
AOI 6	B-169	10/16/2013	---	1.70	---	Shallow	No	Static	
AOI 6	B-170	10/16/2013	---	1.71	---	Shallow	No	Static	
AOI 6	PZ-132A	10/16/2013	---	5.84	---	Shallow	No	Static	
AOI 6	PZ-135A	10/16/2013	---	6.27	---	Shallow	No	Static	
AOI 6	PZ-135B	10/16/2013	---	6.34	---	Shallow	No	Static	
AOI 6	RW-9	10/16/2013	5.06	5.86	0.80	Shallow	No	Static	
AOI 6	SUMP-1	10/16/2013	5.80	5.80	<0.01	Shallow	No	Static	
AOI 6	U-1	10/16/2013	---	8.21	---	Shallow	No	Static	
AOI 6	U-2	10/16/2013	---	6.71	---	Shallow	No	Static	
AOI 6	U-3	10/16/2013	6.33	7.85	1.52	Shallow	No	Static	
AOI 6	U-4	10/16/2013	---	3.28	---	Shallow	No	Static	
AOI 6	U-5	10/16/2013	---	7.27	---	Shallow	No	Static	
AOI 6	URS-1	10/16/2013	---	5.52	---	Shallow	No	Static	
AOI 6	URS-2	10/16/2013	---	4.48	---	Shallow	No	Static	
AOI 6	URS-3	10/16/2013	---	4.15	---	Shallow	No	Static	
AOI 6	URS-4	10/16/2013	---	6.59	---	Shallow	No	Static	
AOI 6	URS-5	10/16/2013	---	5.18	---	Shallow	No	Static	
AOI 6	WP9-3	10/16/2013	---	1.82	---	Shallow	No	Static	
AOI 6	WP9-4	10/16/2013	---	5.68	---	Shallow	No	Static	
AOI 6	WP9-8	10/16/2013	5.16	6.90	1.74	Shallow	No	Static	
AOI 6	WPM-2	10/16/2013	---	3.54	---	Shallow	No	Static	
AOI 6	WPM-3	10/16/2013	---	3.29	---	Shallow	No	Static	
AOI 6	WPM-11	10/16/2013	1.10	1.11	0.01	Shallow	No	Static	
AOI 7	C-49	10/17/2013	---	5.02	---	Shallow	No	Static	
AOI 7	C-50	10/17/2013	---	7.29	---	Shallow	No	Static	
AOI 7	C-50D	10/17/2013	---	11.68	---	Deep	No	Static	
AOI 7	C-51	10/17/2013	---	4.51	---	Shallow	No	Static	
AOI 7	C-52	10/17/2013	---	4.96	---	Shallow	No	Static	
AOI 7	C-53A	10/17/2013	---	3.78	---	Shallow	No	Static	
AOI 7	C-54	10/17/2013	---	0.51	---	Shallow	No	Static	
AOI 7	C-55	10/17/2013	---	5.03	---	Shallow	No	Static	
AOI 7	C-56	10/17/2013	---	2.41	---	Shallow	No	Static	
AOI 7	C-57	10/17/2013	---	2.02	---	Shallow	No	Static	
AOI 7	C-58	10/17/2013	---	2.11	---	Shallow	No	Static	
AOI 7	C-60	10/17/2013	---	3.67	---	Shallow	No	Static	
AOI 7	C-61	10/17/2013	---	3.49	---	Shallow	No	Static	
AOI 7	C-62	10/17/2013	---	4.73	---	Shallow	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 7	C-63	10/17/2013	---	6.51	---	Shallow	No	Static	
AOI 7	C-64	10/17/2013	---	9.53	---	Shallow	No	Static	
AOI 7	C-65	10/17/2013	3.89	4.41	0.52	Shallow	No	Static	
AOI 7	C-65D	10/17/2013	---	2.11	---	Deep	No	Static	
AOI 7	C-95	10/17/2013	---	6.34	---	Shallow	No	Static	
AOI 7	C-96	10/17/2013	---	5.68	---	Shallow	No	Static	
AOI 7	C-97	10/17/2013	16.21	16.22	0.01	Shallow	No	Static	
AOI 7	C-98	10/17/2013	---	5.63	---	Shallow	No	Static	
AOI 7	C-104	10/17/2013	---	6.57	---	Shallow	No	Static	
AOI 7	C-105	10/17/2013	---	3.50	---	Shallow	No	Static	
AOI 7	C-106	10/17/2013	7.74	10.20	2.46	Shallow	No	Static	
AOI 7	C-108	10/17/2013	5.12	5.13	0.01	Shallow	No	Static	
AOI 7	C-109	10/17/2013	---	4.23	---	Shallow	No	Static	
AOI 7	C-110	10/17/2013	---	5.54	---	Shallow	No	Static	
AOI 7	C-111	10/17/2013	---	5.25	---	Shallow	No	Static	
AOI 7	C-112	10/17/2013	---	2.99	---	Shallow	No	Static	
AOI 7	C-113	10/17/2013	---	4.11	---	Shallow	No	Static	
AOI 7	C-114	10/17/2013	---	3.56	---	Shallow	No	Static	
AOI 7	C-127	10/17/2013	---	8.52	---	Shallow	No	Static	
AOI 7	C-129	10/17/2013	---	4.96	---	Shallow/Intermediate	No	Static	
AOI 7	C-129D	10/17/2013	---	10.46	---	Deep	No	Static	
AOI 7	C-130	10/17/2013	---	7.11	---	Shallow	No	Static	
AOI 7	C-131	10/17/2013	---	3.20	---	Shallow	No	Static	
AOI 7	C-132	10/17/2013	---	4.59	---	Shallow	No	Static	
AOI 7	C-133	10/17/2013	---	1.97	---	Shallow	No	Static	
AOI 7	C-134D	10/17/2013	---	11.57	---	Deep	No	Static	
AOI 7	C-136	10/17/2013	---	4.87	---	Shallow	No	Static	
AOI 7	C-137	10/17/2013	---	2.00	---	Shallow	No	Static	
AOI 7	C-138	10/17/2013	---	5.16	---	Shallow	No	Static	
AOI 7	C-139	10/17/2013	---	2.81	---	Shallow	No	Static	
AOI 7	C-140	10/17/2013	---	1.66	---	Shallow	No	Static	
AOI 7	C-142	10/17/2013	---	8.45	---	Shallow/Intermediate	No	Static	
AOI 7	C-143	10/17/2013	---	8.91	---	Shallow/Intermediate	No	Static	
AOI 7	C-144D	10/17/2013	---	12.39	---	Deep	NA	NA	
AOI 7	C-145	10/17/2013	---	5.74	---	Shallow	No	Static	
AOI 7	C-146	10/17/2013	10.99	10.99	<0.01	Shallow	No	Static	
AOI 7	C-147	10/21/2013	9.50	12.48	2.98	Shallow	No	Static	
AOI 7	C-148	10/21/2013	14.63	17.54	2.91	Shallow	Yes	Static	
AOI 7	C-150	10/17/2013	13.84	14.18	0.34	Shallow	No	Static	
AOI 7	C-151	10/17/2013	---	12.61	---	Shallow	No	Static	Casing damaged at 2.60 feet
AOI 7	C-152	10/17/2013	---	10.11	---	Shallow	No	Static	
AOI 7	C-153	10/17/2013	---	14.14	---	Shallow	No	Static	
AOI 7	C-154	10/17/2013	12.06	<0.01	---	Shallow	No	Static	
AOI 7	C-155	10/17/2013	---	6.58	---	Shallow	No	Static	
AOI 7	C-156	10/17/2013	---	4.27	---	Shallow	No	Static	
AOI 7	C-157	10/17/2013	---	3.84	---	Shallow	No	Static	
AOI 7	C-158	10/17/2013	NM	NM	NM	Shallow	No	Static	Casing bent or obstruction at 2.74 feet
AOI 7	C-159	10/17/2013	---	3.87	---	Shallow	No	Static	
AOI 7	C-160	10/17/2013	---	9.84	---	Shallow	No	Static	
AOI 7	C-161	10/17/2013	9.80	10.10	0.30	Shallow	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 7	C-162	10/17/2013	---	9.90	---	Shallow	No	Static	
AOI 7	C-163	10/17/2013	---	5.02	---	Shallow	No	Static	
AOI 7	C-164	10/17/2013	---	4.77	---	Shallow	No	Static	
AOI 7	C-165	10/17/2013	---	6.11	---	Shallow	No	Static	
AOI 7	C-166	10/17/2013	---	6.78	---	Shallow	No	Static	
AOI 7	C-167	10/17/2013	DRY	DRY	DRY	Shallow	No	Static	Well is dry at 12.15 feet.
AOI 7	C-168	10/17/2013	6.39	6.46	0.07	Shallow	No	Static	
AOI 7	C-169	10/21/2013	11.82	14.50	2.68	Shallow	No	Static	
AOI 7	RW-801	10/17/2013	---	19.90	---	Shallow	Yes	Pumping	
AOI 7	RW-802	10/17/2013	---	20.85	---	Shallow	Yes	Pumping	
AOI 7	RW-803	10/17/2013	---	20.55	---	Shallow	Yes	Pumping	
AOI 7	RW-804	10/17/2013	---	20.65	---	Shallow	Yes	Pumping	Formerly C-170
AOI 7	RW-805	10/17/2013	---	17.50	---	Shallow	Yes	Pumping	
AOI 7	RW-806	10/17/2013	---	19.70	---	Shallow	Yes	Pumping	
AOI 7	RW-807	10/17/2013	---	18.50	---	Shallow	Yes	Pumping	
AOI 7	RW-808	10/17/2013	---	18.90	---	Shallow	Yes	Pumping	
AOI 7	RW-809	10/17/2013	---	22.70	---	Shallow	Yes	Pumping	
AOI 7	RW-810	10/17/2013	9.90	9.90	<0.01	Shallow	Yes	Pumping	
AOI 7	RIVER 4	10/17/2013	---	4.53	---	NA	NA	NA	
AOI 7	WP14-2	10/17/2013	8.80	8.87	0.07	Shallow	No	Static	
AOI 8	N-1	10/18/2013	---	12.56	---	Shallow	No	Static	
AOI 8	N-2	10/18/2013	---	18.90	---	Shallow	No	Static	
AOI 8	N-3	10/18/2013	---	14.43	---	Shallow	No	Static	
AOI 8	N-4	10/18/2013	---	19.03	---	Deep	No	Static	
AOI 8	N-5	10/18/2013	---	10.10	---	Shallow	No	Static	
AOI 8	N-6	10/18/2013	---	13.23	---	Shallow	No	Static	
AOI 8	N-8	10/18/2013	---	26.30	---	Shallow	No	Static	
AOI 8	N-9	10/18/2013	---	32.48	---	Deep	No	Static	
AOI 8	N-10	10/18/2013	---	5.16	---	Shallow	No	Static	
AOI 8	N-11	10/18/2013	---	18.86	---	Intermediate	No	Static	
AOI 8	N-12	10/18/2013	NM	NM	NM	Intermediate	No	Static	Filled with rocks at 2.15 feet.
AOI 8	N-13	10/18/2013	---	21.02	---	Deep	No	Static	
AOI 8	N-14	10/18/2013	21.13	21.20	0.07	Intermediate	No	Static	
AOI 8	N-15	10/18/2013	---	20.94	---	Intermediate	No	Static	
AOI 8	N-16	10/18/2013	---	21.79	---	Intermediate	No	Static	
AOI 8	N-17	10/18/2013	---	23.26	---	Intermediate	No	Static	
AOI 8	N-18	10/18/2013	---	21.80	---	Intermediate	No	Static	
AOI 8	N-19	10/18/2013	---	29.59	---	Deep	No	Static	
AOI 8	N-20	10/18/2013	---	17.60	---	Shallow	No	Static	
AOI 8	N-21	10/18/2013	---	23.82	---	Deep	No	Static	
AOI 8	N-23	10/18/2013	11.57	11.57	<0.01	Intermediate	No	Static	
AOI 8	N-24	10/18/2013	---	9.25	---	Shallow	No	Static	
AOI 8	N-25	10/18/2013	3.07	4.08	1.01	Shallow	No	Static	
AOI 8	N-26	10/18/2013	---	6.03	---	Shallow	No	Static	
AOI 8	N-47	10/18/2013	19.93	20.64	0.71	Intermediate	No	Static	
AOI 8	N-67	10/18/2013	---	6.41	---	Shallow	No	Static	
AOI 8	N-68	10/18/2013	14.10	14.31	0.21	Shallow	No	Static	
AOI 8	N-69	10/18/2013	---	15.50	---	Intermediate	No	Static	
AOI 8	N-70	10/18/2013	15.01	15.01	<0.01	Intermediate	No	Static	
AOI 8	N-77	10/18/2013	---	6.30	---	Shallow	No	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 8	N-78	10/18/2013	NM	NM	NM	Intermediate	No	Static	Well destroyed
AOI 8	N-79	10/18/2013	---	11.45	---	Intermediate	No	Static	
AOI 8	N-83	10/18/2013	---	15.60	---	Intermediate	No	Static	
AOI 8	N-84	10/18/2013	---	14.81	---	Shallow	No	Static	
AOI 8	N-85	10/18/2013	---	14.10	---	Shallow	No	Static	
AOI 8	N-86	10/18/2013	---	15.16	---	Intermediate	No	Static	
AOI 8	N-87	10/18/2013	---	15.55	---	Shallow	No	Static	
AOI 8	N-89	10/18/2013	---	14.22	---	Intermediate	No	Static	
AOI 8	N-90	10/18/2013	---	15.18	---	Shallow	No	Static	
AOI 8	N-91	10/18/2013	8.31	10.61	2.30	Shallow	No	Static	
AOI 8	N-92	10/18/2013	---	7.69	---	Shallow	No	Static	
AOI 8	N-93	10/18/2013	---	14.91	---	Shallow	No	Static	
AOI 8	N-94	10/18/2013	---	5.49	---	Shallow	No	Static	
AOI 8	N-97	10/18/2013	---	13.97	---	Other	No	Static	
AOI 8	N-98	10/18/2013	---	23.70	---	Intermediate	No	Static	
AOI 8	N-99	10/18/2013	---	19.78	---	Intermediate	No	Static	
AOI 8	N-100	10/18/2013	---	18.64	---	Intermediate	No	Static	
AOI 8	N-101	10/18/2013	---	16.14	---	Intermediate	No	Static	
AOI 8	N-102	10/18/2013	22.29	23.14	0.85	Intermediate	No	Static	
AOI 8	N-103	10/18/2013	---	17.39	---	Intermediate	No	Static	
AOI 8	N-104	10/18/2013	---	16.83	---	Intermediate	No	Static	
AOI 8	N-105	10/18/2013	---	17.46	---	Intermediate	No	Static	
AOI 8	N-106	10/18/2013	---	11.03	---	Intermediate	No	Static	
AOI 8	N-107	10/18/2013	15.42	15.61	0.19	Intermediate	No	Static	
AOI 8	N-108	10/18/2013	11.60	11.61	0.01	Intermediate	No	Static	
AOI 8	N-112	10/18/2013	9.56	13.54	3.98	Intermediate	No	Static	
AOI 8	N-118	10/18/2013	---	14.39	---	Intermediate	No	Static	
AOI 8	N-127	10/18/2013	---	20.61	---	Intermediate	No	Static	
AOI 8	N-134	10/18/2013	---	17.29	---	Intermediate	No	Static	
AOI 8	N-137	10/18/2013	18.01	18.71	0.70	Intermediate	No	Static	
AOI 8	N-138	10/18/2013	27.68	28.34	0.66	Intermediate	No	Static	
AOI 8	N-139	10/18/2013	27.42	28.34	0.92	Intermediate	No	Static	
AOI 8	PZ-300	10/18/2013	---	17.30	---	Intermediate	No	Static	
AOI 8	RW-200	10/18/2013	---	6.31	---	Intermediate	Yes	Static	
AOI 8	RW-201	10/18/2013	23.27	23.80	0.53	Intermediate	Yes	Static	
AOI 8	RW-202	10/18/2013	---	20.72	---	Intermediate	Yes	Static	
AOI 8	RW-203	10/18/2013	22.78	23.02	0.24	Intermediate	Yes	Static	
AOI 8	RW-204	10/18/2013	19.77	20.81	1.04	Intermediate	Yes	Static	
AOI 8	RW-205	10/18/2013	20.11	22.79	2.68	Intermediate	Yes	Static	
AOI 8	RW-206	10/18/2013	21.15	22.21	1.06	Intermediate	Yes	Static	
AOI 8	RW-300	10/18/2013	14.71	15.00	0.29	Intermediate	Yes	Static	
AOI 8	RW-301	10/18/2013	---	12.23	---	Intermediate	Yes	Static	
AOI 8	RW-302	10/18/2013	---	13.50	---	Intermediate	Yes	Static	
AOI 8	RW-303	10/18/2013	---	14.28	---	Intermediate	Yes	Static	
AOI 8	RW-304	10/18/2013	---	15.04	---	Intermediate	Yes	Static	
AOI 8	RW-305	10/18/2013	---	15.04	---	Intermediate	Yes	Static	
AOI 8	RW-306	10/18/2013	13.12	13.13	0.01	Intermediate	Yes	Static	
AOI 8	RW-307	10/18/2013	---	14.71	---	Intermediate	Yes	Static	
AOI 8	RW-308	10/18/2013	---	16.79	---	Intermediate	Yes	Static	
AOI 8	RW-309	10/18/2013	---	15.71	---	Intermediate	Yes	Static	

**TABLE 1**  
**PHILADELPHIA REFINERY OPERATIONS**  
**A SERIES OF EVERGREEN RESOURCES GROUP, LLC**  
**FOURTH QUARTER 2013 GAUGING DATA**

AOI	Well ID	Date	Depth to LNAPL	Depth to Water	Apparent LNAPL Thickness	Well Classification	Recovery Well Y or N	Static or Pumping	Comments
AOI 8	RW-500	10/18/2013	---	2.88	---	Intermediate	Yes	Static	
AOI 8	RW-501	10/18/2013	---	6.87	---	Intermediate	Yes	Static	
AOI 8	RW-502	10/18/2013	8.54	8.83	0.29	Intermediate	Yes	Static	

**NOTES:**

All measurements are in feet.

LNAPL = Light Non-Aqueous Phase Liquid

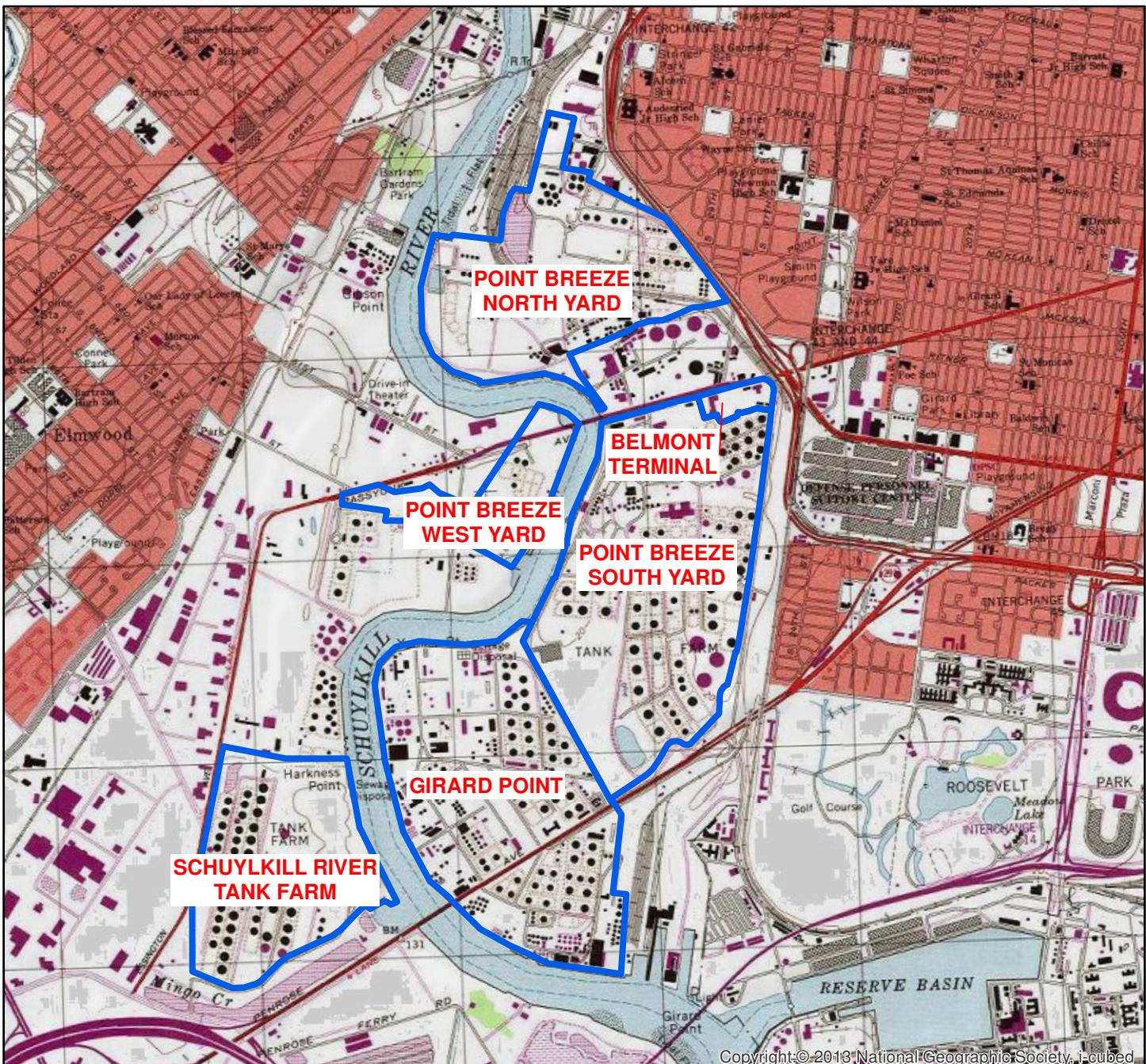
--- = LNAPL not present

NM = Field reading not measured and/or corrected groundwater elevation not calculated due to lack of surveyed reference elevation

NA = Not Accessible, Not Applicable, or Not Available

DRY = Well was dry at time of gauging

# **FIGURES**



QUADRANGLE LOCATION

REFERENCE: USGS 7.5 MINUTE QUADRANGLE; MARCUS HOOK, PA.-NJ-DEL., QUADRANGLE, 1993

IMAGE SOURCE: DVRPC/PASDA 2010

0 750 1,500 3,000 4,500  
Feet



Prepared For:

EVERGREEN RESOURCES MANAGEMENT  
PHILADELPHIA REFINERY  
3144 PASSYUNK AVENUE  
PHILADELPHIA, PA. 19145

Figure Title:

SITE LOCATION MAP

Figure No.:

1



### Stantec Consulting Services Inc.

1060 Andrew Drive, Suite 140  
West Chester, Pennsylvania  
19380

Tel. 610-840-2500  
Fax. 610-840-2501  
[www.stantec.com](http://www.stantec.com)

DRAWN BY: TFB  
CHECKED BY: JLM  
APPROVED BY: JLM  
DATE: 1/17/2014



Stantec Consulting Services Inc.

1060 Andrew Drive, Suite 140  
West Chester, Pennsylvania 19380  
Tel: 610-840-2500  
Fax: 610-840-2501  
www.stantec.com

AERIAL PHOTO SOURCE: DVRPC/PASDA 2010.

- Legend**
- SHALLOW / INTERMEDIATE / DEEP MONITORING WELL
  - SHALLOW / INTERMEDIATE MONITORING WELL
  - UNABLE TO LOCATE WELL
  - SEWER
  - POLLOCK STREET HORIZONTAL WELL
  - BLUE HATCHED AREAS ARE REMEDIATION SYSTEMS DESIGNATED AS INACTIVE
  - WHITE HATCHED AREAS ARE REMEDIATION SYSTEMS DESIGNATED AS CURRENTLY ACTIVE
  - OTHER MONITORING WELL
  - DEEP MONITORING WELL
  - INTERMEDIATE MONITORING WELL
  - SHALLOW MONITORING WELL
  - STAFF GAUGE
  - DAMAGED WELL
  - PIEZOMETER
  - INTERMEDIATE RECOVERY WELL
  - SHALLOW RECOVERY WELL
  - SHALLOW / INTERMEDIATE RECOVERY WELL
  - SHALLOW / INTERMEDIATE O<sub>2</sub> MONITORING WELL
  - AREA OF INTEREST (AOI)

**FIGURE 2**  
**SITE PLAN**

EVERGREEN RESOURCES MANAGEMENT  
PHILADELPHIA REFINERY  
3144 PASSYUNK AVENUE  
PHILADELPHIA, PA, 19145



SCALE: AS SHOWN  
DATE: 1/22/2014  
DRN-TFB  
APR: JLM

**ATTACHMENT 1**

**Remediation System Recovery Data**

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Groundwater and LNAPL Recovery Systems Operational Data**  
**AOI 1: Belmont Terminal**

**Fourth Quarter 2013**

Date	Total Flow (gallons)	Period Total Flow (gallons)	Average Flow Rate (gpm)	LNAPL Recovered in Period (gallons)	Total LNAPL Recovered (gallons)
3-Oct-13	81,424,215	0	0.00	0	246,853
10-Oct-13	81,424,215	0	0.00	0	246,853
15-Oct-13	81,424,215	0	0.00	0	246,853
25-Oct-13	81,424,215	0	0.00	0	246,853
1-Nov-13	81,424,215	0	0.00	0	246,853
8-Nov-13	81,424,215	0	0.00	0	246,853
13-Nov-13	81,424,215	0	0.00	0	246,853
22-Nov-13	81,424,215	0	0.00	0	246,853
27-Nov-13	81,424,215	0	0.00	0	246,853
4-Dec-13	81,424,215	0	0.00	0	246,853
13-Dec-13	81,424,215	0	0.00	0	246,853
20-Dec-13	81,424,215	0	0.00	0	246,853
23-Dec-13	81,424,215	0	0.00	0	246,853
3-Jan-14	81,424,215	0	0.00	0	246,853

**NOTES:**

LNAPL: Light Non-Aqueous Phase Liquid

gpm: gallons per minute

The Belmont Terminal System consists of the Loading Rack System (RW-21, RW-22, RW-23, RW-24, and RW-25) and the Frontage Road System (RW-15 and RW-26 through RW-32). The Belmont Terminal System has two totalizers: one for the Loading Rack System and one for Frontage Road System.

On August 30, 2012, the Frontage Road System was turned off and remained off for the reporting period. The system will remain offline unless there is a significant increase of LNAPL in the recovery wells. The recovery wells were routinely gauged and no product was detected during the reporting period.

On June 5, 2013, the Loading Rack System was turned off and remained off for the reporting period. The system will remain offline in order to maximize recovery in the 26th Street North area. The product pumps in RW-23, RW-24, and RW-25 were checked weekly and manually operated as recoverable product thicknesses accumulate in each well.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**AOI 1: Shunk Street Sewer Biofilter System**  
**pH Data**

**Fourth Quarter 2013**

Date	Leachate pH	Biofilter Treatment Cell - Soil pH		
		Cell 1	Cell 2	Cell 3
1-Nov-13	0.00	5.11	5.29	5.18
22-Nov-13	7.26	0.00	0.00	0.00
20-Dec-13	7.26	5.16	5.32	5.17

**NOTES:**

Leachate recordings are collected on a quarterly basis.

Media pH recordings are collected on a monthly basis.

The system was operational for the reporting period. On November 22, the belts were replaced on the blower. O&M activities were not completed the weeks of December 9-13 and December 23-27, 2013.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**AOI 1: Shunk Street Sewer Ventilation System and Biofilter Operational Data**  
**Organic Vapor Concentrations**

**Fourth Quarter 2013**

Date	Flow Rate (CFM)	Sewer Air PID (ppm)	Total Flow PID (ppm)	Treatment Cell Effluent PID (ppm)			Treatment Cell Media Temperature (°F)		
				Cell #1	Cell #2	Cell #3	Cell #1	Cell #2	Cell #3
3-Oct-13	4,950	0	0	0	0	0	80	80	80
10-Oct-13	4,950	2	2	0	0	0	70	70	70
15-Oct-13	4,950	1	1	0	0	0	70	70	70
25-Oct-13	4,950	2	2	0	0	0	72	72	72
1-Nov-13	4,950	7	7	0	0	0	69	69	69
8-Nov-13	4,950	3	3	0	0	0	68	68	68
13-Nov-13	4,950	1	1	0	0	0	70	70	70
22-Nov-13	4,950	1	1	0	0	0	70	70	70
27-Nov-13	4,950	0	0	0	0	0	64	64	64
4-Dec-13	4,950	0	0	0	0	0	68	68	68
13-Dec-13	---	---	---	---	---	---	---	---	---
20-Dec-13	4,950	3	3	0	0	0	60	60	60
23-Dec-13	---	---	---	---	---	---	---	---	---
2-Jan-14	4,950	1	1	0	0	0	58	58	58

**NOTES:**

CFM: cubic feet per minute

PID: Photoionization detector

ppm: parts per million

°F: Degrees fahrenheit

The sewer air reading is collected from the Shunk Street sewer air stream only.

The air stripper was taken offline on June 17, 2004; therefore, the total flow is equal to the sewer air reading.

The system was operational for the reporting period. On November 22, the belts were replaced on the blower. O&M activities were not completed the weeks of December 9-13 and December 23-27, 2013.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Total Fluids Recovery System Operational Data**  
**AOI 1: 26th Street Sewer Area**

**Fourth Quarter 2013**

Date	Total Flow (gallons)	Period Total Flow (gallons)	Calculated System Flow Rate (gpm)	LNAPL Recovered in Period (gallons)	Total LNAPL Recovered (gallons)
4-Oct-13	44,382,129	487,700	33.87	NA	8,849.60
11-Oct-13	44,382,129	0	0.00	NA	8,849.60
18-Oct-13	44,382,129	0	0.00	NA	8,849.60
25-Oct-13	44,382,129	0	0.00	NA	8,849.60
1-Nov-13	44,382,129	0	0.00	NA	8,849.60
6-Nov-13	44,382,129	0	0.00	NA	8,849.60
13-Nov-13	44,382,129	0	0.00	NA	8,849.60
19-Nov-13	44,387,069	4,940	0.57	NA	8,849.60
26-Nov-13	44,387,069	0	0.00	NA	8,849.60
3-Dec-13	44,864,279	477,210	47.34	NA	8,849.60
9-Dec-13	44,864,279	0	0.00	NA	8,849.60
18-Dec-13	45,208,709	344,430	26.58	NA	8,849.60
23-Dec-13	45,209,389	680	0.09	NA	8,849.60
31-Dec-13	45,745,899	536,510	46.57	NA	8,849.60

**NOTES:**

gpm: gallon per minute

LNAPL: Light Non-Aqueous Phase Liquid

The total flow and total LNAPL recovered includes historical totals from former recovery wells RW-400 through RW-406. The 26th Street Sewer Area (26th Street North) Total Fluids Recovery System consists of 19 total fluids recovery wells (14 wells onsite along 26th Street and five wells offsite on CSX property) which discharge directly to a benzene NESHAP controlled sewer; therefore, the volume of recoverable LNAPL cannot be quantified. None of the CSX wells were active during this reporting period.

The system was operational for the reporting period with the following exceptions: The system was down on arrival on October 4 due to high oil temp on the compressor; ordered replacement parts. On November 6, a new temperature sensor was installed, and the compressor was restarted; shortly afterwards the compressor shut off. On November 19, a representative from Precision Engineering Parts replaced the internal thermostat and the system was restarted. The filter was clogged with iron/debris from the restart; bypassed the filter to let the iron/debris dry out. S-187 was inoperable; removed to repair. On November 25, the compressor was down due to a loose high pressure oil line; repaired oil line and restarted compressor. S-182, S-185, S-186, S-187, S-189, S-192, and RW-400 were frozen on November 25; all frozen pumps were turned off. The pumps in S-182, S-183, and S-188 were restarted on November 26. On December 3, S-185 was hung up. The flow meter was inoperable on December 9; the batteries were replaced and the flow meter was back in service the same day. S-185 was hung up; S-186 and S-189 were inoperable. On December 18, the compressor was down as PES electricians temporarily cut power due to work at the substation; the system was restarted prior to departure. S-182, S-183, S-185, S-186, S-189, and S-192 were frozen and S-187 was inoperable. The system was down on arrival on December 23; restarted system and replaced batteries on the flow meter. On December 31, the flow rate was extremely high and upon inspection a pump was blowing air into the discharge line; repaired line and flow rate returned to normal.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**AOI 1: 26th Street & Packer Avenue Sewers Biofilter System**  
**pH Data**

**Fourth Quarter 2013**

Date	Leachate pH	Biofilter Bed - Soil pH			
		Cell 1	Cell 2	Cell 3	Cell 4
28-Oct-13	7.13	---	---	---	---
22-Nov-13	6.98	---	---	---	---
18-Dec-13	7.03	6.92	6.47	5.88	6.21

**NOTES:**

Leachate recordings are collected on a monthly basis.

Media pH recordings are collected on a quarterly basis.

Cells 3 and 4 were shut off on June 18, 2010 and remained offline for this reporting period as they are not currently needed for vapor treatment.

The system was operational for the reporting period. O&M activities were not completed the weeks of December 9-13 and December 23-27, 2013.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**AOI 1: 26th Street & Packer Avenue Sewers Biofilter System**  
**Historical Organic Vapor Concentrations**

**Fourth Quarter 2013**

Date	Biofilter Influent			Biofilter Effluent							
	Packer Ave. (ppm)	26 <sup>th</sup> Street (ppm)	ST-1 (Combined Influent) (ppm)	Cell-1N	Cell-1S	Cell-2N	Cell-2S	Cell-3N	Cell-3S	Cell-4N	Cell-4S
03-Oct-13	1.0	19.0	11.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
10-Oct-13	3.0	31.0	24.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
15-Oct-13	8.0	16.0	9.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
25-Oct-13	27.0	45.0	29.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
28-Oct-13	23.0	37.0	27.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
07-Nov-13	0.0	23.0	18.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
15-Nov-13	39.0	48.0	38.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
22-Nov-13	22.0	24.0	7.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
27-Nov-13	0.0	11.0	4.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
04-Dec-13	1.0	25.0	7.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
13-Dec-13	---	---	---	---	---	---	---	---	---	---	---
18-Dec-13	9.0	16.0	5.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA
23-Dec-13	---	---	---	---	---	---	---	---	---	---	---
02-Jan-14	10.0	16.0	22.0	0.0	0.0	0.0	0.0	NA	NA	NA	NA

**NOTES:**

ppm: parts per million

NA: Not applicable

Readings are collected using a MultiRAE Lite Photoionization Detector (PID).

Cells 3 and 4 were shut off on June 18, 2010 and remained off for the reporting period as they are not currently needed for vapor treatment.

The system was operational for the reporting period. O&M activities were not completed the weeks of December 9-13 and December 23-27, 2013.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Groundwater and LNAPL Recovery System Operational Data**  
**AOI 2: Pollock Street West End System**

**Fourth Quarter 2013**

Date	Period Total Flow (gallons)	Total Flow (gallons)	LNAPL Recovered in Period (gallons)	Total LNAPL Recovered (gallons)
30-Sep-13	234,780	17,140,915	133.7	53,587
7-Oct-13	246,820	17,387,735	276.4	53,863
14-Oct-13	237,040	17,624,775	214.0	54,077
22-Oct-13	267,460	17,892,235	246.7	54,324
28-Oct-13	194,750	18,086,985	199.8	54,524
30-Oct-13	63,710	18,150,695	60.7	54,584
4-Nov-13	145,300	18,295,995	132.3	54,717
11-Nov-13	147,430	18,443,425	195.6	54,912
18-Nov-13	191,080	18,634,505	280.2	55,192
25-Nov-13	218,400	18,852,905	331.5	55,524
26-Nov-13	26,800	18,879,705	45.0	55,569
2-Dec-13	165,300	19,045,005	191.1	55,760
3-Dec-13	31,000	19,076,005	52.7	55,813
9-Dec-13	174,100	19,250,105	247.6	56,060
16-Dec-13	213,000	19,463,105	225.4	56,286
23-Dec-13	229,700	19,692,805	328.3	56,614
30-Dec-14	224,500	19,917,305	213.5	56,827

**NOTES:**

LNAPL: Light Non-Aqueous Phase Liquid

The groundwater and LNAPL recovery totals do not include historical totals from the former Pollock Street Vertical System recovery wells. The West End System was started on February 23, 2012.

The system was operational for the October reporting period. On November 18, RW-117, RW-126, and RW-127 were hung up; RW-117 and RW-127 were freed, and RW-126 was removed for cleaning. Semi-annual maintenance was performed December 11 through December 13. All pumps, minus S-313 and S-315, were reinstalled and restarted on December 13; S-313 and S-315 were reinstalled and restarted on December 17.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Total Fluids Recovery System Operational Data**  
**AOI 2: Pollock Street Horizontal Wells**

**Fourth Quarter 2013**

Actual Dates in Period	Reporting Period (Internal)	Days in Period	HW-1 Days of Operation Within Period	HW-1 Water Recovered During Period (gallons)	HW-2 Days of Operation Within Period	HW-2 Water Recovered During Period (gallons)	HW-3 Days of Operation Within Period	HW-3 Water Recovered During Period (gallons)	Total Fluids Extracted During Period (gallons)	Total Fluids Extracted (gallons)	LNAPL Recovered During Period (gallons)
01/01/2012 - 01/20/2012	start 1Q2012	20	2	23,040	2	10,742	20	442,944	476,726	21,534,898	NA
12/24/2011 - 01/20/2012	Jan. 2012	28	10	115,200	10	53,712	28	620,122	789,034	21,534,898	NA
01/21/2012 - 02/17/2012	Feb. 2012	28	25	288,000	24	128,909	28	620,122	1,037,030	22,571,928	NA
02/18/2012 - 03/16/2012	Mar. 2012	28	27	311,040	28	150,394	27	597,974	1,059,408	23,631,336	NA
03/17/2012 - 03/31/2012	end 1Q2012	15	14	161,280	15	80,568	15	332,208	574,056	24,205,392	NA
03/17/2012 - 04/20/2012	Apr. 2012	35	34	391,680	35	187,992	34	753,005	1,332,677	24,964,013	NA
04/21/2012 - 05/18/2012	May 2012	28	27	311,040	28	150,394	28	620,122	1,081,555	26,045,568	NA
05/19/2012 - 06/22/2012	Jun. 2012	35	33	380,160	32	171,878	23	509,386	1,061,424	27,106,992	NA
06/23/2012 - 06/30/2012	end 2Q2012	8	8	92,160	8	42,970	8	177,178	312,307	27,419,300	NA
06/23/2012 - 07/20/2012	Jul. 2012	28		322,560	28	150,394	28	620,122	1,093,075	28,200,068	NA
07/21/2012 - 08/24/2012	Aug. 2012	35	35	403,200	35	187,992	35	775,152	1,366,344	29,566,412	NA
08/25/2012 - 09/21/2012	Sep. 2012	28	28	322,560	28	150,394	28	620,122	1,093,075	30,659,487	NA
09/22/2012 - 09/30/2012	end 3Q2012	9	9	103,680	9	48,341	9	199,325	351,346	31,010,832	NA
09/22/2012 - 10/19/2012	Oct. 2012	28	27	311,040	27	145,022	28	620,122	1,076,184	31,735,671	NA
10/20/2012 - 11/16/2012	Nov. 2012	28	26	299,520	28	150,394	28	620,122	1,070,035	32,805,706	NA
11/17/2012 - 12/21/2012	Dec. 2012	35	35	403,200	33	177,250	35	775,152	1,355,602	34,161,308	NA
12/22/2012 - 12/31/2012	end 4Q2012	10	9	103,680	10	53,712	10	221,472	378,864	34,540,172	NA
12/22/2012 - 01/25/2013	Jan. 2013	35	34	391,680	35	187,992	35	775,152	1,354,824	35,516,132	NA
01/26/2013 - 02/22/2013	Feb. 2013	28		322,560	28	150,394	24	531,533	1,004,486	36,520,618	NA
02/23/2013 - 03/22/2013	Mar. 2013	28	26	299,520	26	139,651	28	620,122	1,059,293	37,579,911	NA
03/23/2013 - 03/31/2013	end 1Q2013	9	9	103,680	9	48,341	9	199,325	351,346	37,931,256	NA
03/23/2013 - 04/19/2013	Apr. 2013	28	13	149,760	28	150,394	28	620,122	920,275	38,500,186	NA
04/20/2013 - 05/24/2013	May 2013	35	12	172,800	35	187,992	35	775,152	1,135,944	39,636,130	NA
05/25/2013 - 06/21/2013	Jun. 2013	28	Totalizer	215,320	20	107,424	28	620,122	942,866	40,578,996	NA
06/21/2013 - 06/30/2013	end 2Q2013	10	Totalizer	49,920	10	53,712	10	221,472	325,104	40,904,100	NA
6/22/2013 - 7/26/2013	Jul. 2013	35	Totalizer	209,560	33	177,250	34	753,005	1,139,814	42,043,914	NA
7/27/2013 - 8/23/2013	Aug. 2013	28	Totalizer	264,210	28	150,394	28	620,122	1,034,725	43,078,639	NA
8/24/2013 - 9/20/2013	Sept. 2013	28	Totalizer	10,510	27	145,022	28	620,122	775,654	43,854,293	NA
9/21/2013 - 9/30/2013	end 3Q2013	10	Totalizer	8,730	10	53,712	10	221,472	283,914	44,138,207	NA
9/21/2013 - 10/25/2013	Oct. 2013	35	Totalizer	193,685	35	187,992	35	775,152	1,156,829	45,295,036	NA
10/26/2013 - 11/22/2013	Nov. 2013	28	Totalizer	117,353	23	123,538	28	620,122	861,012	46,156,048	NA
11/23/2013 - 12/20/2013	Dec. 2013	28	Totalizer	113,387	28	150,394	28	620,122	883,902	47,039,951	NA
12/21/2013 - 12/31/2013	end 4Q2013	11	Totalizer	51,134	11	59,083	11	243,619	353,836	47,393,787	NA

**NOTES:**

LNAPL: Light Non-Aqueous Phase Liquid

NA: Not Applicable

Pump tests were performed in March 2011 for the horizontal wells so that recovered volumes could be estimated based on flow rates and system up-time, beginning in the second quarter of 2011. A second pump test was completed following the installation of a new pump at HW-1 on May 13, 2013. The HW-1 flow rate was estimated at 10 gallons per minute (gpm), HW-2 at 3.73 gpm, and HW-3 at 15.38 gpm. Beginning May 25, 2013, HW-1 flow is measured and reported by a totalizer.

HW-1 was operational for the October reporting period. HW-1 was shut down on November 5 and November 6 for quarterly maintenance. HW-1 was operational for the December reporting period.

HW-2 was operational for the October reporting period. HW-2 was down on October 30, 2013 due to a clog in the main line. HW-2 was shut down on November 5 and November 6 for quarterly maintenance. On November 18, HW-2 was shut down due to a blown diaphragm; removed, rebuilt pump, and restarted on November 21. HW-2 was operational for the December reporting period.

HW-3 was operational for the reporting period.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Groundwater and LNAPL Recovery System Operational Data**  
**AOI-4: Penrose Avenue**

**Fourth Quarter 2013**

Date	Period Total Flow (gallons)	Total Flow (gallons)	Average Daily Flow (gpd)	LNAPL Recovered in Period (gallons)	Total LNAPL Recovered (gallons)
30-Sep-13	57,700	3,811,880	14,350	0	198.3
09-Oct-13	137,100	3,948,980	15,233	0	198.3
17-Oct-13	34,500	3,983,480	4,313	0	198.3
25-Oct-13	53,700	4,037,180	6,713	0	198.3
31-Oct-13	51,900	4,089,080	8,650	0	198.3
08-Nov-13	85,800	4,174,880	10,725	0	198.3
14-Nov-13	70,200	4,245,080	11,700	0	198.3
22-Nov-13	83,200	4,328,280	10,882	0	198.3
26-Nov-13	39,700	4,367,980	9,925	0	198.3
05-Dec-13	36,900	4,404,880	4,100	0	198.3
13-Dec-13	69,900	4,474,780	8,738	0	198.3
19-Dec-13	59,100	4,533,880	9,850	0.70	199.0
23-Dec-13	37,400	4,571,280	9,350	0.31	199.3
02-Jan-14	95,900	4,667,180	9,590	0.31	199.6

**NOTES:**

LNAPL: Light Non-Aqueous Phase Liquid

The Penrose System consists of 18 recovery wells (RW-700 through RW-717) which was started on March 20, 2013. Groundwater and LNAPL are extracted using pneumatic pumps, and total fluids pass through an oil/water separator (OWS). The groundwater is discharged to the Philadelphia Water Department (PWD) sanitary sewer system along Penrose Avenue, and LNAPL is recovered in a 550-gallon storage tank.

The system was operational for the reporting period with the following exceptions: On October 10 and October 11, the system was down on high OWS level. The pumps in recovery wells RW-705 through RW-717 were shut down on October 11. Plant air was down on October 16; the air was restored on October 17, and the system was restarted. The system was operational for the November and December reporting periods.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Groundwater and LNAPL Recovery System Operational Data**  
**AOI 6: 27 Pump House**

**Fourth Quarter 2013**

Date	Period Total Flow (gallons)	Total Flow (gallons)	Average Flow Rate (gpm)	LNAPL Recovered In Period (gallons)	Total LNAPL Recovered (gallons)
01-Oct-13	0	11,134,675	0.00	0.50	12,910.32
08-Oct-13	0	11,134,675	0.00	0.25	12,910.57
14-Oct-13	0	11,134,675	0.00	0.25	12,910.82
22-Oct-13	0	11,134,675	0.00	0.25	12,911.07
30-Oct-13	0	11,134,675	0.00	1.00	12,912.07
07-Nov-13	0	11,134,675	0.00	0.50	12,912.57
12-Nov-13	0	11,134,675	0.00	0.375	12,912.95
20-Nov-13	0	11,134,675	0.00	0.25	12,913.20
26-Nov-13	0	11,134,675	0.00	0.25	12,913.45
04-Dec-13	0	11,134,675	0.00	0	12,913.45
13-Dec-13	0	11,134,675	0.00	0	12,913.45
17-Dec-13	0	11,134,675	0.00	0.50	12,913.95
23-Dec-13	0	11,134,675	0.00	0	12,913.95
31-Dec-13	0	11,134,675	0.00	1.50	12,915.45

**NOTES:**

LNAPL: Light Non-Aqueous Phase Liquid

gpm: gallons per minute

The groundwater recovery system was turned off on September 20, 2010 due to the absence of recoverable product. Recovery wells B-124, B-132, B-137, B-139, B-142, B-143, and B-147 contained absorbent socks. On April 10, 2013, the absorbent socks were removed from recovery wells B-132, B-137, B-139, and B-147 due to lack of product. Absorbent socks remain in recovery wells B-124, B-142, and B-143.

During the reporting period, wells were routinely gauged and the socks were replaced when necessary. LNAPL recovery volumes are recorded using a graduated beaker and recovered product is transferred to the system holding tank. Passive remediation will continue until no measurable product is observed or until recoverable thicknesses of LNAPL return to the recovery wells.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**Total Fluids Recovery System Operational Data**  
**AOI 7: 3 Separator System**

**Fourth Quarter 2013**

Date	Total Flow (gallons)	Period Total Flow (gallons)	Calculated System Flow Rate (gpm)	LNAPL Recovered in Period (gallons)	Total LNAPL Recovered (gallons)
1-Oct-13	5,884,885	83,800	8.31	203.1	32,409.8
8-Oct-13	5,966,285	81,400	8.08	376.7	32,786.5
14-Oct-13	5,966,285	0	0.00	0.0	32,786.5
21-Oct-13	6,074,585	108,300	10.74	441.6	33,228.1
28-Oct-13	6,126,085	51,500	5.11	611.3	33,839.4
29-Oct-13	6,144,285	18,200	12.64	155.9	33,995.3
1-Nov-13	6,188,685	44,400	10.28	646.9	34,642.2
7-Nov-13	6,253,385	64,700	7.49	588.5	35,230.7
8-Nov-13	6,265,685	12,300	8.54	162.3	35,393.1
12-Nov-13	6,310,285	44,600	7.74	303.4	35,696.5
20-Nov-13	6,387,385	77,100	6.69	512.8	36,209.3
26-Nov-13	6,442,485	55,100	6.38	259.1	36,468.4
4-Dec-13	6,526,485	84,000	7.29	231.1	36,699.5
9-Dec-13	6,581,485	55,000	7.64	218.6	36,918.2
17-Dec-13	6,672,785	91,300	7.93	168.5	37,086.6
23-Dec-13	6,739,685	66,900	7.74	119.6	37,206.3
31-Dec-13	6,829,685	90,000	7.81	144.6	37,350.9

**NOTES:**

gpm: gallons per minute

LNAPL: Light Non-Aqueous Phase Liquid

The 3 Separator System is a hydraulic control system constructed of ten recovery wells (RW-801 through RW-810) which was started on August 23, 2012. Groundwater and LNAPL are extracted using pneumatic submersible pumps, and total fluids pass through an oil/water separator. Water is discharged to an onsite process sewer, and LNAPL is recovered in a tank and recycled by the refinery. Groundwater and LNAPL recovery totals include system startup through the end of this reporting period.

The system was operational for the reporting period with the following exceptions: On October 8, the 3 Separator System was shut down due to lack of carbon. The system was restarted on October 16. The system was operational for the November and December reporting period.

**Philadelphia Refinery Operations**  
**A Series of Evergreen Resources Group, LLC**  
**AOI 8: Jackson Street Sewer Water Curtain**

**Fourth Quarter 2013**

Date	PID readings (ppm)			Comments
	Blower	Water Curtain	Interceptor Chamber	
30-Sep-13	NA	0.0	0.0	
08-Oct-13	NA	0.0	0.0	
14-Oct-13	NA	0.0	0.0	
22-Oct-13	NA	0.0	0.0	
01-Nov-13	NA	0.0	0.0	
07-Nov-13	NA	0.0	0.0	
15-Nov-13	NA	0.0	0.0	
22-Nov-13	NA	0.0	0.0	
29-Nov-13	NA	0.0	0.0	
05-Dec-13	NA	0.0	0.0	
13-Dec-13	NM	NM	NM	
20-Dec-13	NA	0.0	0.0	
23-Dec-13	NM	NM	NM	
31-Dec-13	NA	0.0	0.0	

**NOTES:**

PID: Photoionization detector

ppm: parts per million

NA: Not Available (PID readings are not collected at the blower.)

NM: Not Measured

The totalizer was removed on December 11, 2009.

The system was operational throughout the reporting period. O&M activities were not completed the weeks of December 9-13 and December 23-27, 2013.

**ATTACHMENT 2**  
**26<sup>th</sup> Street South (S-50 Area) Report**



**PERFORMANCE MONITORING AND QUARTERLY UPDATE  
26<sup>TH</sup> STREET SOUTH (AOI-1)**

**SUNOCO, INC (R&M)  
PHILADELPHIA REFINERY  
PHILADELPHIA, PA**

**January 2014**

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## APPENDICES

- Attachment A   Groundwater Laboratory Analytical Data  
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 Attachment C   DO, Benzene and Groundwater Elevation vs Time Graphs



## 1.0 INTRODUCTION

The information contained in this report is intended to be included as an Attachment to the Quarterly Remediation Status Report for the Philadelphia Refinery and Belmont Terminal prepared by Stantec. The area investigated by Aquaterra and summarized in this report includes the southern portion of AOI-1, also known as the #2 Tank Farm or the 26<sup>th</sup> Street South area. Historic sampling of groundwater in this area had been sporadic; however, over the course of the sampling history relatively high occurrences of benzene have been reported. Therefore, Aquaterra has been performing quarterly sampling of select monitoring wells across the area to provide further definition of the extent of the light non-aqueous phase liquids (LNAPL) and dissolved phase constituents of concern (COCs) in groundwater. This report also provides a summary of the remediation system operation, maintenance, and sampling activities.

## 2.0 QUARTERLY GROUNDWATER SAMPLING

### 2.1 Sampling Methodology

On 13 December 2013, select monitoring wells (S-50, S-210, S-226, S-230, S-231, and S-232) within the 26<sup>th</sup> Street South study area were gauged and sampled as part of a quarterly groundwater monitoring program. Prior to sampling, depth to water measurements were collected for use in calculating groundwater elevations and for the generation of a groundwater gradient map (**Figure 1**). Five additional wells (S-51, S-52, S-127, S-209, and S-262) were also gauged during this sampling event. Depths to water ranged from 16.81 (S-127) to 26.51 (S-209) feet below top of casing. The groundwater gradient map illustrates groundwater flow generally toward the east. LNAPL was not measured in any wells during this groundwater sampling event; therefore, all wells were sampled. Groundwater gauging information collected as part of the groundwater sampling event is summarized in **Table 1**.

Sampling of wells was performed using the three well volume purge protocol for groundwater sampling using a whale pump. Samples were submitted to Lancaster Laboratories, Inc. (Lancaster) for analysis of the following COCs: benzene, toluene, ethylbenzene, xylenes (BTEX), and methyl tertiary-butyl ether (MTBE) via US EPA Method 8260B. Laboratory analytical data and chain of custody are included as **Attachment A**.

### 2.2 Sampling Results

Laboratory data indicate that benzene was reported above the Pennsylvania Department of Environmental Protection (PADEP) Act 2 Statewide Health Standard (SHS) Medium Specific Concentration (MSC) in the wells that were sampled. Toluene and MTBE were also reported above its SHS MSC in well S-226. All other compounds were reported below their respective SHS MSCs. Laboratory data are summarized in **Table 1**.

## 3.0 REMEDIATION ACTIVITIES

### 3.1 Oxygen Injection System

Between January and March 2009, 54 nested injection points within 27 well boreholes (at each well location there is one shallow and one deep) were installed as part of the oxygen injection remediation system. Deep injection points range in depth from 29 to 41 feet below grade, and shallow injection points range in depth from 25 to 33.5 feet below grade, each with two feet of slotted screen. The nested configuration was utilized due to aquifer heterogeneity and the presence of clay layers which may inhibit the movement of oxygen to the impacted zones. The goal of the remediation system is to provide a barrier against offsite migration of the COCs within the aquifer.

Four ‘banks’ of wells were set to inject into multiple wells at a time so that oxygen is pulsed into the aquifer. This pulsing of the system aids in transfer of oxygen from the vapor to dissolved phase, and the low flow rate allows for maximum dissolved oxygen (DO) saturation without causing contaminant volatilization. The system was initially set up to only inject within the deep points (except at IW-01, where there was blockage in the deep point); however, due to lower than projected target DO concentrations in surrounding monitoring wells, the system was adjusted on 18 November 2009 to inject into the shallow points so that DO injection was being performed closer to the monitoring well screen intervals. Initially, injection wells IW-17, IW-18 and IW-19 remained as deep injection points due to the deeper well screen construction of S-232. However, on 6 April 2012, injection was switched from IW-18D to IW-18S due to blockage in the deep point. On 14 January 2010, IP-25 was switched back to the deep well due to loss of pressure in the shallow well. Injection well locations are illustrated on **Figure 2**.

### 3.2 Operation and Maintenance

Routine operation and maintenance (O&M) activities are generally conducted by Aquaterra on a monthly basis, during which Aquaterra records system operation information including system run time and operating pressures. Adjustments are made during each visit to maintain optimal operating conditions. Injection pressures are measured at each point during these visits and adjusted to approximately 30 standard cubic feet per hour (scfh). Oxygen purity is also measured during each visit. O&M visits were conducted on 24 October 2013, 26 November 2013, and 13 December 2013.

DO and ORP measurements are also collected during each O&M visit from injection points as well as nearby monitoring wells (S-50, S-210, S-226, S-230, S-231 and S-232). The pH, depth to water, and thickness of LNAPL, if present, are also recorded from the monitoring wells proximal to the system (**Table 2**). During the October and November monthly O&M visit, LNAPL was recorded in wells S-210 (0.15 feet and 0.07 feet, respectively). During the December monthly O&M visit, LNAPL was recorded in well S-210 (0.05 feet) and well S-230 (0.05 feet).

Due to the large number of injection points, half of the points are measured for DO and ORP concentrations during each monthly visit. DO data are presented in **Tables 3a and 3b** for the shallow and deep injection points, respectively. ORP data are presented in **Tables 4a and 4b** for the shallow and deep injection points, respectively. The DO data is also presented graphically for the shallow and deep wells. A ‘goal line’ of 2 milligrams per liter (mg/L) is presented on the graphs to illustrate where aerobic conditions exist. The 30 mg/L line is also illustrated on the

graphs for each well as this is the goal concentration for wells in which oxygen is being injected. These graphs are included in **Attachment B**.

### 3.3 Annual Groundwater Sampling

In addition to the sampling activities summarized in Section 2.1, six groundwater monitoring wells proximal to the remediation system are sampled for additional parameters to aid in determining if aerobic conditions are maintained and if there is a reduction in the benzene concentrations and other COCs in the surficial aquifer. The select wells are sampled for natural attenuation parameters and microbial analyses. Generally when monitoring for these parameters, wells upgradient of the plume, within the plume and downgradient of the plume are monitored so that spatial analysis of the results can be performed. However, as the system provides a barrier along the downgradient property boundary, no downgradient wells are available for monitoring. Therefore, the following wells are sampled to provide information both within and outside of the plume, as defined by the high benzene concentrations. The wells include: S-50, S-52, S-117, S-226, S-231, and S-232.

The wells were initially sampled on a quarterly basis; however, the quarterly sampling was reduced to an annual schedule. The wells were last sampled during the second quarter of 2013. Sample parameters include: DO, ORP, pH, conductivity, and temperature (all with field probe using flow-through cell); carbon dioxide ( $\text{CO}_2$ ) using a field meter; alkalinity, ferrous iron, nitrate/nitrite, sulfate, total dissolved solids (TDS), total organic carbon (TOC), total inorganic carbon (TIC), biochemical oxygen demand (BOD), and hydrocarbon degrading bacteria including heterotrophic plate count via laboratory analyses.

In addition to the annual sampling, some of these wells are monitored for DO, ORP, and pH during the O&M visits as noted in Section 3.2. These field parameters are provided in **Table 2**. Graphs were generated illustrating the natural log of benzene concentration, versus groundwater elevation and DO concentration in each of the six wells nearest the remediation system (**Attachment C**). Product thicknesses are also added to these graphs since field measurements cannot be collected in the presence of LNAPL.

### 3.4 Future Sampling Activities

Future sampling and system monitoring activities will be conducted by Stantec starting with the first quarter of 2014. It is anticipated that the quarterly schedule of groundwater sampling will continue for the wells noted in Section 2.1. The select wells utilized for monitoring of attenuation parameters and microbial analysis (as discussed in Section 3.3) will continue to be sampled on an annual basis. They should be sampled again in the second quarter of 2014. As noted in the previous report, Stantec continues to monitor and sample select wells along the property boundary as part of their annual perimeter sampling program, which includes wells S-41, S-43, S-44, S-50, S-51, S-226, and S-232.

S-209

S-117

S-262

S-127

S-52

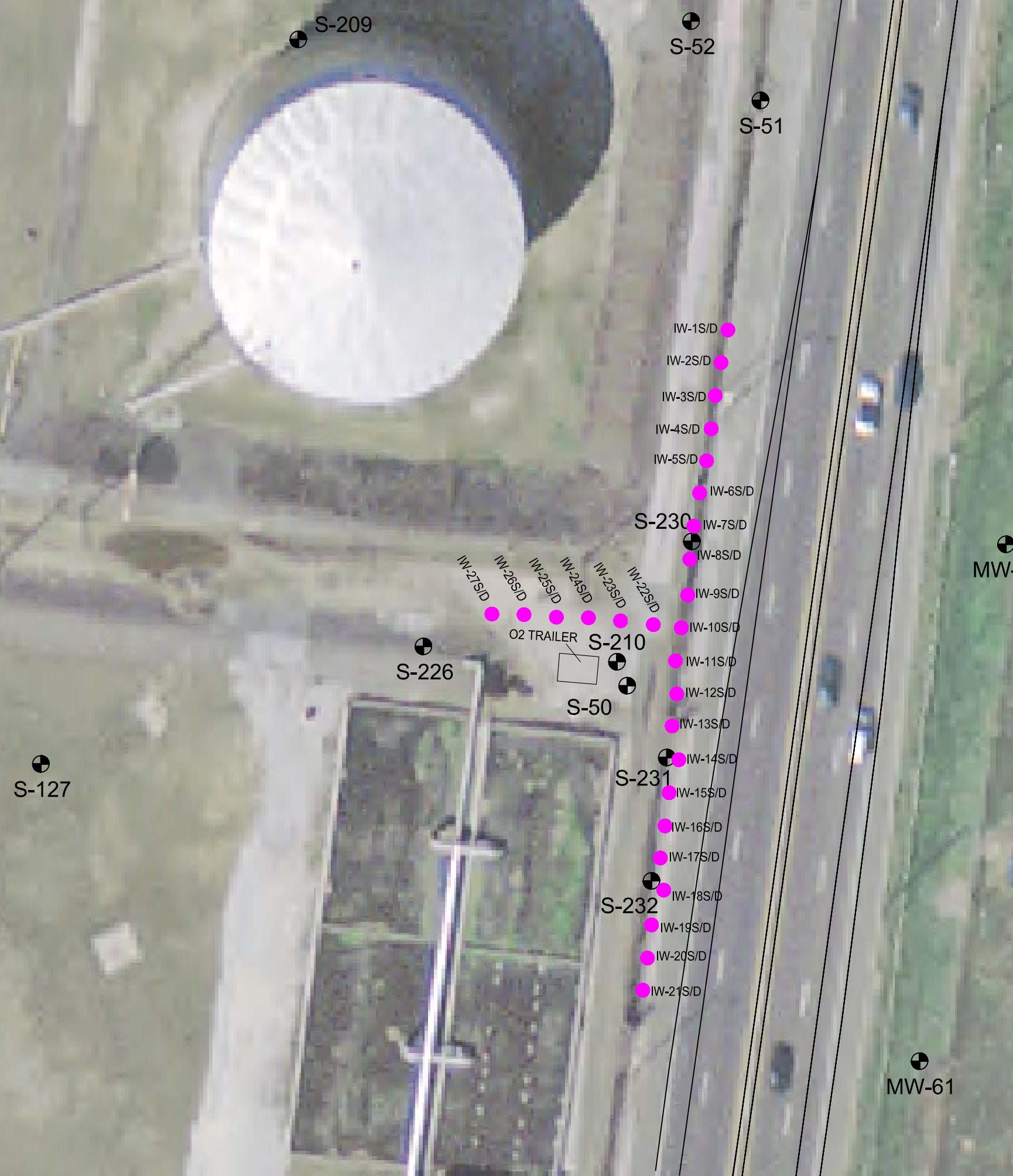
S-51

S-230 (0.14)  
 S-226 (0.58) 0.50  
 S-210 (0.26) 0.40  
 S-50 (0.33) 0.30  
 S-231 (0.20) 0.20  
 S-232 (0.37) 0.30  
 0.40

LEGEND

- MONITORING WELL
- GROUNDWATER CONTOUR
- (0.14) GROUNDWATER ELEVATION (feet)

DRAFTED BY: SS	GROUNDWATER CONTOUR MAP 11 SEPTEMBER 2013	
CHECKED BY: TD		
REVIEWED BY: TD	SUNOCO PHILADELPHIA REFINERY 26TH STREET SOUTH - S-50 AREA PHILADELPHIA, PENNSYLVANIA	
NORTH	AQUATERRA TECHNOLOGIES, INC. 122 S. CHURCH ST, WEST CHESTER, PA 19381	
SCALE:	DATE:	FIGURE
0'	60'	10-22-2013
		1



LEGEND

● MONITORING WELL

● INJECTION POINT LOCATION

DRAFTED BY:  
BB

CHECKED BY:  
TD

REVIEWED BY:  
TD

NORTH

OXYGEN INJECTION WELL LOCATION  
MAP

SUNOCO PHILADELPHIA REFINERY  
26TH STREET SOUTH - S-50 AREA  
PHILADELPHIA, PENNSYLVANIA

AQUATERRA TECHNOLOGIES, INC.  
122 S. CHURCH ST, WEST CHESTER, PA 19381

SCALE: 1"=50' DATE: 4-27-2009 FIGURE 2



0' 50'



**TABLE 1**  
Underwater Gauging and Sampling Summary  
26th Street South Area (AOI-1)  
Sunoco, Inc. Philadelphia Refinery

Well ID	Sample Date	Casing Elev (feet)	Total Depth	Groundwater Monitoring																											
				SPH Thickness	GW Elev	Benzene ug/l	Ethylene-benzene ug/l	Total Xylenes ug/l	MTBE ug/l	Isopropylbenzene ug/l	Naphthalene ug/l	1,2-Dibromoethane (EDB) ug/l	1,2-Dichloroethane (EDC) ug/l	Dissolved Lead mg/l	Fluorene ug/l	Phenanthrene ug/l	Chrysene ug/l	Pyrene ug/l	Sulfate mg/l	Nitrate Nitrogen mg/l	Nitrite Nitrogen mg/l	Organic Carbon (total) mg/l	Inorganic Carbon (total) mg/l	Total Carbon mg/l	Alkalinity <sup>1</sup> (pH 4.5) mg/l as CaCO <sub>3</sub>	Alkalinity <sup>2</sup> (pH 8.3) mg/l as CaCO <sub>3</sub>	Dissolved Solids (total) mg/l	Ferrous Iron mg/l	Biochemical Oxygen Demand mg/l	HC Bacteria in Water cfu/ml	Heterotrophic Plate Count cfu/ml
S-41	6/10/08	25.75	36	25.74	-	-	0.01	13	5	<1	3	43	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/27/09			26.51	-	-	-0.76	44	7	12	28	20	98	<5	<0.030	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	6/23/09			25.81	-	-	-0.06	15	3	4	4	45	100	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	9/16/09			25.37	-	-	0.38	37	11	<5	6	28	46	<5	<0.029	<5	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	12/9/09			24.76	-	-	0.99	12	5	2	5	40	29	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	6/18/12			26.03	-	-	-0.28	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
S-42I	6/10/08	25.72	68	25.41	-	-	0.31	1	<1	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/27/09			26.11	-	-	-0.39	25	2	7	19	11	4	<5	<0.032	3	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	6/23/09			25.41	-	-	0.31	6	<1	<1	2	14	2	<5	4	4	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	9/16/09			24.98	-	-	0.74	78	20	2	10	<1	<2	<5	<0.029	<5	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	12/9/09			24.43	-	-	1.29	29	<1	<1	<1	NA	NA	NA	NA	NA	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	6/18/12			22.87	-	-	0.45	220	21	110	92	1	19	21	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NN	NA	NA		
S-43	9/14/07	23.32	35	-	-	-	-	1,200	69	320	220	<10	NA	NA	NA	NA	NA	NA	NA	<0.50	NA	8.6	NA	NA	NA	326	NA	16.8	<100	3,500	
	10/24/07			24.04	-	-	-0.72	930	46	180	130	6	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	305	NA	NA	NA	NA	
	6/10/08			24.78	-	-	-1.46	1,300	98	370	290	5	42	71	<0.030	<2	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	3/27/09			24.11	-	-	-0.79	1,600	90	520	350	7	52	110	<0.029	<5	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/23/09			23.71	-	-	-0.39	590	34	140	100	<5	26	32	<0.029	<5	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	9/16/09			22.87	-	-	0.45	220	21	110	92	1	19	21	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NN	NA	NA	NA	
S-44	9/14/07	23.48	40	-	-	-	-	1,100	24	28	58	210	NA	NA	NA	NA	NA	NA	NA	<0.50	NA	35.5	NA	NA	NA	454	NA	34.1	<100	7,800	
	10/24/07			-	-	-	-	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	381	NA	NA	NA	NA	
	6/10/08			25.64	-	-	-2.16	1,000	23	16	33	260	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	3/27/09			26.25	-	-	-2.77	620	22	25	65	310	23	<5	<0.030	<1	<0.01	<5	5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/23/09			25.70	-	-	-2.22	1,300	27	18	37	290	37	<5	<0.030	<10	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	9/16/09			25.33	-	-	-1.85	2,300	130	40	110	250	59	<5	<0.030	<2	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	12/9/09			22.43	-	-	1.05	1,200	25	18	37	260	46	<5	<0.029	<2	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/18/12			25.97	-	-	-2.49	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
S-45	6/11/08	21.57	24	22.92	-	-	-1.35	11	2	<1	<1	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	3/27/09			22.90	-	-	-1.33	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NS-Dry	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	6/23/09			14.68	-	-	6.89	6.89	23	2	1	2	10	<4	<1	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	9/16/09			21.61	-	-	-0.04	23	2	<1	<1	1	1	1	<1	<1	<1	<1.0	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	12/9/09			22.87	-	-	-1.30	<1	<1	<1	<1	1	1	1	<0.029	<1	<1	<1.0	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/18/12			22.88	-	-	-1.31	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
S-46	6/12/08	22.61	33	21.44	-	-	1.17	77	25	52	46	63	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	3/27/09			22.38	-	-	0.23	47	16	29	34	46	160	5	<0.030	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/23/09			21.82	-	-	0.79	51	16	30	32	56	180	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	9/16/09			21.13	-	-	1.48	33	10	10	17	27	56	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	12/9/09			20.98	-	-	1.63	28	9	12	11	27	66	5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/18/12			21.81	-	-	0.80	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
S-47I	6/12/08	22.21	42	21.09	-	-	1.12	20	12	1	6	70	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	3/27/09			22.02	-	-	0.19	2	3	1	5	54	62	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
	6/23/09			21.46	-	-	0.75	8	2	2	5	61																			

**TABLE 1**  
**Underwater Gauging and Sampling Summary**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**

Caloco, Inc. - Philadelphia Refinery																																
Well ID	Sample Date	Casing Elev (feet)	Total Depth	SPH Thickness	GW Elev	Benzene	Toluene	Ethylene-benzene	Total Xylenes	MTBE ug/l	Isopropylbenzene ug/l	Naphthalene ug/l	1,2-Dibromoethane (EDB) ug/l	1,2-Dichloroethane (EDC) ug/l	Dissolved Lead mg/l	Fluorene ug/l	Phenanthrene ug/l	Chrysene ug/l	Pyrene ug/l	Sulfate mg/l	Nitrate Nitrogen mg/l	Nitrite Nitrogen mg/l	Organic Carbon (total) mg/l	Inorganic Carbon (total) mg/l	Total Carbon mg/l	Alkalinity <sup>1</sup> (pH 8.3) mg/l as CaCO <sub>3</sub>	Alkalinity <sup>2</sup> (pH 4.5) mg/l as CaCO <sub>3</sub>	Dissolved solids (total) mg/l	Ferrous Iron mg/l	Biochemical Oxygen Demand mg/l	HC Bacteria in Water cfu/ml	Heterotrophic Plate Count cfu/ml
S-52	6/11/08	23.54	40	23.27	-	-	0.27	12	<5	<5	1,300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	3/25/09	23.90	-	-	-0.36	280	3	7	18	1,500	24	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/7/09	23.52	-	-	0.02	44	2	<1	2	1,300	23	<5	<0.029	<1	<1.0	<5	<5	<5	<5	<5	<0.10	<0.050	24.3	NA	337	<0.20	426	13.8	12.5			
	6/22/09	23.12	-	-	0.42	51	3	<1	3	1,200	32	<5	<0.029	<1	<1.0	<5	<5	<5	<5	<5	<0.10	<0.050	24.1	NA	338	<2.0	430	24.7	13.5			
	9/16/09	22.76	-	-	0.78	21	3	1	3	1,100	33	<5	<0.029	<1	<1.0	<5	<5	<5	<5	<5	<0.10	<0.050	25.9	133	159	<2.0	431	29.0	8.6			
	12/10/09	22.45	-	-	1.09	6	3	2	2	930	18	<4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/17/10	22.38	-	-	1.16	4	2	<1	2	930	18	<4	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/1/10	22.41	-	-	1.13	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/14/11	23.49	-	-	0.05	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	5/16/11	22.91	-	-	0.63	14	27	<1	6	320	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	7/21/11	23.17	-	-	0.37	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/2/12	22.86	-	-	0.68	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/18/12	23.30	-	-	0.24	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	8/9/12	23.46	-	-	0.08	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	10/18/12	23.49	-	-	0.05	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/22/13	23.58	-	-	-0.04	6	3	<1	<1	300	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	12/13/13	23.35	-	-	0.19	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
S-95	6/10/08	22.99	31	22.47	-	-	0.52	<1	<1	1	2	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/27/09	23.19	-	-	-0.20	6	2	<1	5	3	94	<5	<0.030	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
	6/23/09	22.55	-	-	0.44	18	2	2	7	4	96	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
	9/16/09	22.10	-	-	0.89	6	2	<1	4	3	100	<5	<0.029	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
	12/9/09	21.58	-	-	1.41	2	<1	<1	2	2	32	<5	<0.030	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
	6/18/12	22.66	-	-	0.33	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
S-117	8/6/08	18.41	29	17.20	-	-	1.21	7,400	43	900	69	89	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/25/09	18.12	-	-	0.29	250	6	<1	16	20	12	9	<0.030	<1	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA				
	5/7/09	17.58	-	-	0.83	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/23/09	17.34	-	-	1.07	300	6	74	12	31	10	20	<0.029	<1	<1.0	<5	<5	<5	65.6	<0.10	0.05	10.1	NA	182	<2.0	305	33.6	7.1				
	9/16/09	16.88	-	-	1.53	370	<5	14	9	6	<10	<5	<0.029	<5	<1.0	<5	<5	<5	8.2	<1.0	<0.050	5.8	46.5	52.3	107	<2.0	128	17.9				
	12/10/09	16.29	-	-	2.12	47	2	49	3	2	7	14	<0.029	<1	<1.0	<5	<5	<5	32.3	<0.10	<0.050	4	22.3	26.3	58.7	<2.0	99	9.5				
	3/17/10	16.87	-	-	1.54	120	8	89	8	16	12	26	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/1/10	16.52	-	-	1.89	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/14/11	17.84	-	-	0.57	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/16/11	17.20	-	-	1.21	27	25	27	7	28	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	7/21/11	17.34	-	-	1.07	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/2/12	17.25	-	-	1.16	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/18/12	17.54	-	-	0.87	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	8/9/12	17.75	-	-	0.66	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	10/18/12	17.75	-	-	0.66	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/22/13	17.87	-	-	0.54	89	19	100	14	36	NA	NA	NA	NA	NA																	

**TABLE 1**  
**Underwater Gauging and Sampling Summary**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**

Well ID	Sample Date	Casing Elev (feet)	Total Depth	SPH Thickness		GW Elev	Benzene ug/l	Toluene ug/l	Ethylene-benzene ug/l	Total Xylenes ug/l	MTBE ug/l	Isopropylbenzene ug/l	Naphthalene ug/l	1,2-Dibromoethane (EDB) ug/l	1,2-Dichloroethane (EDC) ug/l	Dissolved Lead mg/l	Fluorene ug/l	Phenanthrene ug/l	Chrysene ug/l	Pyrene ug/l	Sulfate mg/l	Nitrate Nitrogen mg/l	Nitrite Nitrogen mg/l	Organic Carbon (total) mg/l	Inorganic Carbon (total) mg/l	Total Carbon mg/l	Alkalinity <sup>1</sup> (pH 4.5) mg/l as CaCO <sub>3</sub>	Alkalinity <sup>2</sup> (pH 8.3) mg/l as CaCO <sub>3</sub>	Dissolved solids (total) mg/l	Ferrous Iron mg/l	Biochemical Oxygen Demand mg/l	HC Bacteria in Water cfu/ml	Heterotrophic Plate Count cfu/ml
				DTW	DTP																												
S-210	6/12/08	23.69	40	23.78	-	-0.09	34,000	5,800	470	1,400	190	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/23/09			24.49	-	-0.80	28,000	140	530	620	130	<100	120	<0.030	<50	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/7/09			24.08	-	-0.39	30,000	120	630	1,000	140	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/23/09			23.71	-	-0.02	56,000	160	1,100	990	160	<200	160	<0.029	<100	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	7/21/09			23.79	-	-0.10	41,000	8,100	570	2,800	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	8/18/09			23.65	-	0.04	27,000	9,100	520	3,800	150	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	9/16/09			23.38	Sheen	Sheen	0.31	48,000	17,000	640	3,200	<200	<400	520	<0.030	<200	<1.0	<47	<47	<47	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	10/22/09			24.36	24.24	0.12	-0.58	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	11/25/09			24.07	-	-0.38	50,000	390	890	1,100	120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	12/10/09			23.48	-	0.21	45,000	470	660	1,100	130	<100	320	<0.029	<50	<1.0	6	9	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/17/10			23.60	-	0.09	33,000	130	650	1,000	76	36	350	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	6/1/10			23.68	-	0.01	39,000	99	620	760	140	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	9/7/10			24.39	23.59	0.80	-0.10	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	11/9/10			24.75	23.72	1.03	-0.29	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	3/14/11			24.20	-	-0.51	27,000	1,800	170	810	<100	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/16/11			23.81	23.76	0.05	-0.08	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	7/21/11			24.21	24.01	0.20	-0.37	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	12/21/11			23.13	23.07	0.06	0.61	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	3/2/12			23.91	-	-0.22	NS	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	6/18/12			24.24	24.20	0.04	-0.52	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	8/9/12			24.25	23.87	0.38	-0.27	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	10/17/12			24.40	24.37	0.03	-0.69	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	1/15/13			24.61	24.57	0.04	-0.89	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	4/26/13			24.50	-	-0.81	NS	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	5/22/13			24.39	-	-0.70	NS	NS	NS	NS	NS	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	9/11/13			23.43	-	0.26	19,000	420	820	360	72	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	12/13/13			24.22	24.18	0.04	-0.50	NS	NS	NS	NS	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
S-226	6/11/08	22.02	40	21.83	-	-0.19	57,000	560	1,200	5,000	260	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	3/23/09			22.51	-	-0.49	7,300	87	160	560	740	25	740	<0.030	<10	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	5/7/09			22.20	-	-0.18	4,500	53	59	210	660	NA	NA	NA	NA	NA	NA	NA	NA	<5.0	<5.0	<10.0	0.10	0.10	22.2	NA	NA	244	<2.0	335	38.3	19.4	<100
	6/23/09			21.85	-	0.17	4,600	96	36	130	720	22	11	<0.029	<10	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	7/21/09			21.86	-	0.16	34,000	980	270	1,500	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	8/18/09			21.73	-	0.29	29,000	1,100	76	760	230	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	9/16/09			21.43	-	0.59	4,700	90	77	340	630	28	22	<0.029	<10	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	10/22/09			22.22	-	-0.20	28,000	810	330	2,400	390	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	11/25/09			22.04	-	-0.02	18,000	390	410	2,100	400	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA		
	12/10/09			21.67	-	0.35	3,600	53	87	110	820	33	47	<0.029	<5	<1.0	<5	<5	<5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA			
	3/17/10			22.63	-	-0.61	6,700	110	98	280	660	22	40	NA	NA</td																		



**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-50	3/23/09	22.48	23.08	-	-	-0.60	NM	0.71	-69.4	NM	NM	7.63
	4/1/09	NM	-	-	-	NM	NM	1.25	-49	NM	NM	NM
	4/15/09	NM	-	-	-	NM	NM	3.05	-55	NM	NM	NM
	4/22/09	NM	-	-	-	NM	NM	NM	-50	NM	NM	NM
	5/7/09	22.62	-	-	-0.14	NM	1.58	-66	NM	512		6.3
	5/21/09	NM	-	-	-	NM	NM	1.97	NM	NM	NM	NM
	6/4/09	NM	-	-	-	NM	NM	0.85	-61	NM	NM	NM
	6/23/09	22.33	-	-	0.15	NM	0.30	-116.7	0.920	280		6.52
	7/8/09	22.49	-	-	-0.01	NM	0.70	-114	NM	NM		6.2
	7/21/09	22.62	-	-	-0.14	NM	0.67	-128	NM	NM		6.3
	8/4/09	22.78	-	-	-0.30	NM	1.03	-136	NM	NM		6.6
	8/19/09	22.39	-	-	0.09	NM	0.70	-119	NM	NM		6.5
	9/9/09	22.09	-	-	0.39	NM	1.01	-116	NM	NM		7.0
	9/16/09	22.14	-	-	0.34	17.60	0.21	-146.4	1.016	452		6.75
	9/23/09	22.03	-	-	0.45	NM	1.14	-112	NM	NM		6.6
	10/7/09	22.75	-	-	-0.27	NM	1.07	-128	NM	NM		6.6
	10/22/09	23.06	-	-	-0.58	NM	1.39	-109	NM	NM		6.6
	11/18/09	22.98	-	-	-0.50	NM	1.45	-95	NM	NM		6.6
	11/25/09	22.84	-	-	-0.36	NM	NM	NM	NM	NM		NM
	12/2/09	22.90	-	-	-0.42	NM	1.05	-89	NM	NM		6.50
	12/10/09	21.29	-	-	1.19	17.11	1.12	-96.5	0.909	515		6.76
	12/16/09	22.94	-	-	-0.46	NM	1.00	-91.0	NM	NM		6.7
	12/30/09	22.79	-	-	-0.31	NM	5.56	-79.0	NM	NM		6.7
	1/14/10	22.78	-	-	-0.30	NM	1.32	-133	NM	NM		6.7
	1/28/10	22.67	-	-	-0.19	NM	0.97	-131	NM	NM		6.7
	3/4/10	22.60	-	-	-0.12	NM	2.02	-130	NM	NM		6.8
	3/17/10	22.40	-	-	0.08	18.07	0.14	-134.7	1.039	406		6.9
	3/25/10	22.33	-	-	0.15	NM	1.41	-122	NM	NM		7.0
	4/15/10	22.19	-	-	0.29	NM	1.81	-117	NM	NM		6.8
	4/29/10	22.30	-	-	0.18	NM	2.05	-134	NM	NM		6.9
	5/20/10	22.47	-	-	0.01	NM	2.42	-130	NM	NM		7.2
	6/1/10	22.49	-	-	-0.01	27.23	0.29	-159.3	1.068	304		7.0
	6/3/10	22.52	-	-	-0.04	NM	2.25	-89	NM	NM		6.8
	6/17/10	22.50	-	-	-0.02	NM	1.70	-100	NM	NM		6.9
	7/13/10	22.59	-	-	-0.11	NM	1.21	-122	NM	NM		6.8
	7/29/10	22.50	-	-	-0.02	NM	2.72	-58	NM	NM		7.5
	8/12/10	22.57	-	-	-0.09	NM	2.29	-49	NM	NM		8.1
	8/26/10	22.59	-	-	-0.11	NM	3.04	-46	NM	NM		8.0
	9/9/10	22.61	-	-	-0.13	NM	9.40	24	NM	NM		8.9
	9/23/10	22.88	-	-	-0.40	NM	2.39	-50	NM	NM		7.2
	10/7/10	22.78	-	-	-0.30	NM	4.22	-14	NM	NM		6.7
	10/28/10	22.83	-	-	-0.35	NM	3.35	-67	NM	NM		6.9
	11/9/10	22.84	-	-	-0.36	NM	NM	NM	NM	NM		NM
	11/12/10	22.96	-	-	-0.48	NM	3.70	-69	NM	NM		7.7
	11/23/10	22.82	-	-	-0.34	NM	6.48	-65	NM	NM		7.3
	12/16/10	23.13	-	-	-0.65	NM	4.58	-17	NM	NM		7.7
	12/30/10	23.29	-	-	-0.81	NM	4.02	-8	NM	NM		7.5
	1/14/11	23.31	-	-	-0.83	NM	3.81	-43	NM	NM		7.0
	2/10/11	23.26	-	-	-0.78	NM	3.18	-73	NM	NM		7.1
	3/9/11	23.15	-	-	-0.67	NM	3.96	-95	NM	NM		7.4
	3/14/11	22.98	-	-	-0.50	17.58	3.29	-55.1	0.82	NM		6.9
	4/21/11	22.79	-	-	-0.31	NM	9.08	-49.5	NM	NM		7.3
	5/16/11	22.58	-	-	-0.10	17.40	7.14	-80.1	0.255	NM		7.4
	5/19/11	22.56	-	-	-0.08	NM	4.71	-69	NM	NM		6.7
	6/16/11	22.73	-	-	-0.25	NM	4.72	-42	NM	NM		6.4
	7/21/11	22.89	-	-	-0.41	NM	3.10	-9.9	NM	NM		5.8
	8/17/11	22.94	-	-	-0.46	NM	1.81	-5	NM	NM		6.7
	9/22/11	21.82	-	-	0.66	NM	2.53	-15	NM	NM		7.9
	10/27/11	21.74	-	-	0.74	NM	NM	NM	NM	NM		NM
	11/28/11	22.17	-	-	0.31	NM	4.02	70	NM	NM		7.7
	12/21/11	21.87	-	-	0.61	17.93	2.08	54	0.35	NM		6.9
	1/26/12	22.07	-	-	0.41	NM	1.48	-162	NM	NM		6.7
	2/29/12	22.58	-	-	-0.10	NM	3.85	55.1	NM	NM		6.7
	3/16/12	22.51	-	-	-0.03	NM	5.14	-40.4	NM	NM		7.6
	4/6/12	22.79	-	-	-0.31	NM	3.60	22.8	NM	NM		7.1
	5/15/12	22.84	-	-	-0.36	NM	4.81	-34.7	NM	NM		6.92
	6/14/12	22.96	-	-	-0.48	NM	0.90	-25.0	NM	NM		6.35
	6/18/12	22.96	-	-	-0.48	18.27	4.26	-130.0	NM	NM		6.76
	7/16/12	23.30	-	-	-0.82	NM	2.20	-88.9	NM	NM		6.36
	8/8/12	23.20	-	-	-0.72	NM	5.47	-34.2	NM	NM		6.45
	9/11/12	23.12	-	-	-0.64	NM	7.93	-11.8	NM	NM		7.03
	11/27/12	23.19	-	-	-0.71	NM	8.71	-38.6	NM	NM		6.91
	12/31/12	23.38	-	-	-0.90	NM	15.04	50.4	NM	NM		8.01
	1/17/13	23.49	-	-	-1.01	NM	1.41	5.5	NM	NM		6.62
	2/27/13	23.15	-	-	-0.67	NM	5.74	120.0	NM	NM		NM
	4/26/13	22.23	-	-	0.25	NM	1.04	-10.0	NM	NM		6.19
	5/23/13	23.15	-	-	-0.67	NM	1.10	-120.0	NM	NM		6.54
	6/18/13	22.77	-	-	-0.29	NM	1.92	-53.0	NM	NM		6.54
	8/30/13	22.14	-	-	0.34	NM	1.83	-133.4	NM	NM		NM
	9/11/13	22.15	-	-	0.33	NM	1.74	-142.4	NM	NM		6.76
	9/30/13	22.39	-	-	0.09	NM	6.93	-121.1	NM	NM		6.43
	10/24/13	22.65	-	-	-0.17	NM	2.88	-33.00	NM	NM		7.24
	11/26/13	22.89	-	-	-0.41	NM	3.03	10.00	NM	NM		7.31
	12/13/13	23.10	-	-	-0.62	NM	6.18	125.00	NM	NM		9.17

**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-52	3/25/09	23.54	23.90	-	-	-0.36	NM	0.18	-94.3	NM	NM	NM
	5/7/09	23.52	-	-	-	0.02	NM	NM	NM	NM	504	NM
	6/22/09	23.12	-	-	-	0.42	NM	0.33	-116.2	0.873	336	6.62
	9/16/09	22.76	-	-	-	0.78	15.96	0.33	-131.5	0.880	460	6.81
	12/10/09	22.45	-	-	-	1.09	14.61	0.25	-135.9	0.878	312	6.89
	3/17/10	22.38	-	-	-	1.16	15.15	0.65	-133.8	0.894	356	6.9
	6/1/10	22.41	-	-	-	1.13	22.2	6.57	-84.6	0.977	294	7.07
	3/14/11	23.49	-	-	-	0.05	NM	NM	NM	NM	NM	NM
	5/16/11	22.91	-	-	-	0.63	15.18	3.66	-7.50	0.450	NM	6.79
	12/21/11	22.27	-	-	-	1.27	NM	NM	NM	NM	NM	NM
	6/18/12	23.30	-	-	-	0.24	NM	NM	NM	NM	NM	NM
S-117	3/25/09	18.41	18.12	-	-	0.29	NM	0.25	-229.9	NM	NM	NM
	5/7/09	17.58	-	-	-	0.83	NM	NM	NM	NM	9,999	NM
	6/23/09	17.34	-	-	-	1.07	NM	0.25	-98.3	0.521	288	6.33
	9/16/09	16.88	-	-	-	1.53	17.75	0.50	-101.2	0.236	319	6.57
	12/10/09	16.29	-	-	-	2.12	13.48	0.28	-97.5	0.215	2,064	6.78
	3/17/10	16.87	-	-	-	1.54	16.87	0.23	-112.6	0.552	3,783	6.53
	6/1/10	16.52	-	-	-	1.89	18.97	1.70	-92.2	1.087	293	6.76
	3/14/11	17.84	-	-	-	0.57	NM	NM	NM	NM	NM	NM
	5/16/11	17.20	-	-	-	1.21	15.54	3.80	-11.30	0.355	NM	6.38
	12/21/11	16.66	-	-	-	1.75	NM	NM	NM	NM	NM	NM
	6/18/12	17.54	-	-	-	0.87	NM	NM	NM	NM	NM	NM

**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-210	3/23/09	23.69	24.49	-	-	-0.80	NM	0.47	-48.8	NM	NM	7.17
	4/1/09	NM	-	-	-	NM	NM	1.57	-88.0	NM	NM	NM
	4/15/09	NM	-	-	-	NM	NM	4.02	-53.0	NM	NM	NM
	4/22/09	NM	-	-	-	NM	NM	2.04	-64.0	NM	NM	NM
	5/7/09	24.08	-	-	-	-0.39	NM	0.90	-46.00	NM	NM	NM
	5/21/09	NM	-	-	-	NM	NM	0.83	NM	NM	NM	NM
	6/4/09	NM	-	-	-	NM	NM	0.58	-72.00	NM	NM	NM
	6/23/09	23.71	-	-	-	-0.02	NM	1.16	-82.0	NM	NM	NM
	7/8/09	23.69	-	-	-	0.00	NM	0.95	-118.0	NM	NM	6.3
	7/21/09	23.79	-	-	-	-0.10	NM	1.86	-89.0	NM	NM	6.1
	8/4/09	23.82	23.79	0.03	-	-0.11	NM	NM	NM	NM	NM	NM
	8/19/09	23.65	23.62	0.03	-	0.06	NM	NM	NM	NM	NM	NM
	9/9/09	23.30	23.29	0.01	-	0.40	NM	NM	NM	NM	NM	NM
	9/16/09	23.38	-	-	-	0.31	NM	NM	NM	NM	NM	NM
	9/23/09	23.29	23.20	0.09	-	0.47	NM	NM	NM	NM	NM	NM
	10/7/09	23.88	23.79	0.09	-	-0.12	NM	NM	NM	NM	NM	NM
	10/22/09	24.36	24.24	0.12	-	-0.58	NM	NM	NM	NM	NM	NM
	11/25/09	24.07	-	-	-	-0.38	NM	NM	NM	NM	NM	NM
	12/2/09	24.11	-	-	-	-0.42	NM	1.54	-92	NM	NM	6.5
	12/10/09	23.48	-	-	-	0.21	NM	NM	NM	NM	370	NM
	12/16/09	24.11	-	-	-	-0.42	NM	1.63	-88	NM	NM	6.6
	12/30/09	23.97	-	-	-	-0.28	NM	1.04	-76	NM	NM	6.6
	1/14/10	23.90	-	-	-	-0.21	NM	1.55	-94	NM	NM	6.5
	1/28/10	23.80	-	-	-	-0.11	NM	0.73	-119	NM	NM	6.7
	3/4/10	23.78	-	-	-	-0.09	NM	1.55	-110	NM	NM	6.7
	3/17/10	23.60	-	-	-	0.09	NM	NM	NM	NM	NM	NM
	3/25/10	23.49	-	-	-	0.20	NM	1.78	-86	NM	NM	6.6
	4/15/10	23.38	-	-	-	0.31	NM	1.81	-111	NM	NM	6.7
	4/29/10	23.49	-	-	-	0.20	NM	2.19	-109	NM	NM	6.8
	5/20/10	23.65	-	-	-	0.04	NM	2.34	-116	NM	NM	6.9
	6/1/10	23.68	-	-	-	0.01	NM	NM	NM	289	NM	NM
	6/3/10	23.68	-	-	-	0.01	NM	1.14	-106	NM	NM	6.8
	6/17/10	23.71	-	-	-	-0.02	NM	1.89	-101	NM	NM	6.8
	7/13/10	24.27	23.58	0.69	-	-0.06	NM	NM	NM	NM	NM	NM
	7/29/10	24.25	23.42	0.83	-	0.06	NM	NM	NM	NM	NM	NM
	8/12/10	24.39	23.50	0.89	-	-0.03	NM	NM	NM	NM	NM	NM
	8/26/10	24.34	23.61	0.73	-	-0.10	NM	NM	NM	NM	NM	NM
	9/9/10	24.39	23.59	0.80	-	-0.10	NM	NM	NM	NM	NM	NM
	9/23/10	24.74	23.80	0.94	-	-0.34	NM	NM	NM	NM	NM	NM
	10/7/10	24.58	23.70	0.88	-	-0.23	NM	NM	NM	NM	NM	NM
	10/28/10	24.75	23.69	1.06	-	-0.27	NM	NM	NM	NM	NM	NM
	11/9/10	24.75	23.72	1.03	-	-0.29	NM	NM	NM	NM	NM	NM
	11/12/10	24.76	23.85	0.91	-	-0.39	NM	NM	NM	NM	NM	NM
	11/23/10	24.70	23.68	1.02	-	-0.24	NM	NM	NM	NM	NM	NM
	12/16/10	24.85	24.10	0.75	-	-0.60	NM	NM	NM	NM	NM	NM
	12/30/10	23.16	22.30	0.86	1.18	NM	NM	NM	NM	NM	NM	NM
	1/14/11	24.71	24.40	0.31	-	-0.79	NM	NM	NM	NM	NM	NM
	2/10/11	22.74	22.41	0.33	1.20	NM	NM	NM	NM	NM	NM	NM
	3/9/11	24.38	24.35	0.03	-	-0.67	NM	NM	NM	NM	NM	NM
	3/14/11	24.20	-	-	-	-0.51	17.09	4.40	-30	0.66	NM	6.7
	4/21/11	24.09	24.00	0.09	-	-0.33	NM	NM	NM	NM	NM	NM
	5/16/11	23.81	23.76	0.05	-	-0.08	NM	NM	NM	NM	NM	NM
	5/19/11	23.82	23.75	0.07	-	-0.08	NM	NM	NM	NM	NM	NM
	6/16/11	24.04	23.87	0.17	-	-0.22	NM	NM	NM	NM	NM	NM
	7/21/11	24.21	24.02	0.19	-	-0.38	NM	NM	NM	NM	NM	NM
	8/17/11	24.15	24.11	0.04	-	-0.43	NM	NM	NM	NM	NM	NM
	9/22/11	23.05	22.99	0.06	-	0.69	NM	NM	NM	NM	NM	NM
	10/27/11	22.93	22.90	0.03	-	0.78	NM	NM	NM	NM	NM	NM
	11/28/11	23.42	23.39	0.03	-	0.29	NM	NM	NM	NM	NM	NM
	12/21/11	23.13	23.07	0.06	-	0.61	NM	NM	NM	NM	NM	NM
	1/26/12	23.35	23.31	0.04	-	0.37	NM	NM	NM	NM	NM	NM
	2/29/12	23.86	23.54	0.32	-	0.07	NM	NM	NM	NM	NM	NM
	3/16/12	23.94	23.64	0.30	-	-0.02	NM	NM	NM	NM	NM	NM
	4/6/12	24.22	23.92	0.30	-	-0.31	NM	NM	NM	NM	NM	NM
	5/15/12	24.10	24.08	0.02	-	-0.39	NM	NM	NM	NM	NM	NM
	6/14/12	24.29	24.25	0.04	-	-0.57	NM	NM	NM	NM	NM	NM
	6/18/12	24.24	24.20	0.04	-	-0.52	NM	NM	NM	NM	NM	NM
	7/16/12	24.60	24.40	0.20	-	-0.76	NM	10.79	-31.80	NM	NM	6.19
	8/8/12	24.60	24.40	0.20	-	-0.76	NM	12.01	85.30	NM	NM	6.18
	9/11/12	24.46	24.41	0.05	-	-0.73	NM	NM	NM	NM	NM	NM
	11/27/12	24.45	24.40	0.05	-	-0.72	NM	NM	NM	NM	NM	NM
	12/31/12	24.65	24.60	0.05	-	-0.92	NM	NM	NM	NM	NM	NM
	1/17/13	24.70	24.58	0.12	-	-0.92	NM	NM	NM	NM	NM	NM
	2/27/13	24.42	24.41	0.01	-	-0.72	NM	NM	NM	NM	NM	NM
	4/26/13	24.50	-	-	-	-0.81	NM	1.13	57.00	NM	NM	6.18
	5/23/13	24.41	-	-	-	-0.72	NM	1.01	-79.00	NM	NM	6.34
	6/18/13	24.21	-	-	-	-0.52	NM	1.45	-48.00	NM	NM	6.37
	8/30/13	23.43	23.41	0.02	-	0.28	NM	NM	NM	NM	NM	NM
	9/11/13	23.43	-	-	-	0.26	NM	1.17	-94.30	NM	NM	6.55
	9/30/13	23.70	23.60	0.10	-	0.07	NM	NM	NM	NM	NM	NM
	10/24/13	23.97	23.82	0.15	-	-0.17	NM	NM	NM	NM	NM	NM
	11/26/13	24.18	24.11	0.07	-	-0.44	NM	NM	NM	NM	NM	NM
	12/13/13	24.25	24.20	0.05	-	-0.52	NM	NM	NM	NM	NM	NM

**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-226	3/23/09	22.02	22.51	-	-	-0.49	NM	0.25	-70.9	NM	NM	NM
	4/1/09	NM	-	-	-	NM	NM	7.00	-20	NM	NM	NM
	4/15/09	NM	-	-	-	NM	NM	5.28	-26	NM	NM	NM
	4/22/09	NM	-	-	-	NM	NM	0.88	-56	NM	NM	NM
	5/7/09	22.20	-	-	-	-0.18	NM	0.32	-73	NM	2,883	6.5
	5/21/09	NM	-	-	-	NM	NM	1.80	NM	NM	NM	NM
	6/4/09	NM	-	-	-	NM	NM	1.06	-14	NM	NM	NM
	6/23/09	21.85	-	-	-	0.17	NM	0.22	-99.3	0.670	282	6.63
	7/8/09	21.80	-	-	-	0.22	NM	4.34	22	NM	NM	5.7
	7/21/09	21.86	-	-	-	0.16	NM	2.13	-16	NM	NM	5.7
	8/4/09	21.82	-	-	-	0.20	NM	4.12	-36.0	NM	NM	6.4
	8/19/09	21.73	-	-	-	0.29	NM	0.48	-125	NM	NM	6.6
	9/9/09	21.49	-	-	-	0.53	NM	3.63	120	NM	NM	5.7
	9/16/09	21.43	-	-	-	0.59	16.43	0.25	-97.2	0.663	321	6.69
	9/23/09	21.35	-	-	-	0.67	NM	2.25	-44	NM	NM	6.3
	10/7/09	21.95	-	-	-	0.07	NM	2.47	-35	NM	NM	6.3
	10/22/09	22.22	-	-	-	-0.20	NM	1.80	-58	NM	NM	6.4
	11/18/09	22.11	-	-	-	-0.09	NM	1.27	-86	NM	NM	6.5
	11/25/09	22.04	-	-	-	-0.02	NM	NM	NM	NM	NM	NM
	12/2/09	22.14	-	-	-	-0.12	NM	1.78	-42	NM	NM	6.2
	12/10/09	21.67	-	-	-	0.35	14.91	0.27	-117.9	0.75	573	6.76
	12/16/09	22.12	-	-	-	-0.10	NM	2.37	21	NM	NM	6.2
	12/30/09	21.96	-	-	-	0.06	NM	1.84	-20	NM	NM	6.3
	1/14/10	21.90	-	-	-	0.12	NM	1.6	-18	NM	NM	6.1
	1/28/10	21.84	-	-	-	0.18	NM	1.71	-47	NM	NM	6.3
	3/4/10	21.77	-	-	-	0.25	NM	2.28	-59	NM	NM	6.5
	3/17/10	22.63	-	-	-	-0.61	16.19	0.14	-112	0.76	432	6.8
	3/25/10	21.51	-	-	-	0.51	NM	1.94	-74	NM	NM	6.5
	4/15/10	21.35	-	-	-	0.67	NM	2.62	-82	NM	NM	6.6
	4/29/10	21.51	-	-	-	0.51	NM	2.91	-83	NM	NM	6.9
	5/20/10	21.60	-	-	-	0.42	NM	2.20	-115	NM	NM	7.1
	6/1/10	22.04	18.45	*3.59	2.67	NM	NM	NM	NM	284	NM	
	6/3/10	22.09	21.52	0.57	0.36	NM	NM	NM	NM	NM	NM	
	6/17/10	22.22	21.54	0.68	0.31	NM	NM	NM	NM	NM	NM	
	7/13/10	22.31	21.65	0.66	0.21	NM	NM	NM	NM	NM	NM	
	7/29/10	22.00	21.59	0.41	0.33	NM	NM	NM	NM	NM	NM	
	8/12/10	21.33	21.30	0.03	0.71	NM	NM	NM	NM	NM	NM	
	8/26/10	21.86	-	-	-	0.16	NM	16.88	-30	NM	NM	7.8
	9/9/10	21.85	21.81	0.04	0.20	NM	NM	NM	NM	NM	NM	
	9/23/10	22.31	22.02	0.29	-0.07	NM	NM	NM	NM	NM	NM	
	10/7/10	22.05	21.95	0.10	0.04	NM	NM	NM	NM	NM	NM	
	10/28/10	22.25	21.96	0.29	-0.01	NM	NM	NM	NM	NM	NM	
	11/9/10	22.38	22.00	0.38	-0.08	NM	NM	NM	NM	NM	NM	
	11/12/10	22.78	21.97	0.81	-0.15	NM	NM	NM	NM	NM	NM	
	11/23/10	22.56	21.88	0.68	-0.03	NM	NM	NM	NM	NM	NM	
	12/16/10	22.92	22.11	0.81	-0.29	NM	NM	NM	NM	NM	NM	
	12/30/10	24.83	24.35	0.48	-2.45	NM	NM	NM	NM	NM	NM	
	1/14/11	23.16	22.41	0.75	-0.58	NM	NM	NM	NM	NM	NM	
	2/10/11	24.49	24.40	0.09	-2.40	NM	NM	NM	NM	NM	NM	
	3/9/11	22.68	22.41	0.27	-0.46	NM	NM	NM	NM	NM	NM	
	3/14/11	22.23	-	-	-0.21	15.96	6.15	84.1	0.567	NM	7.2	
	4/21/11	22.10	22.05	0.05	-0.04	NM	NM	NM	NM	NM	NM	
	5/16/11	21.80	-	-	0.22	15.57	4.74	-14.1	0.389	NM	6.72	
	5/19/11	21.85	-	-	0.17	NM	2.51	-37	NM	NM	6.3	
	6/16/11	21.95	-	-	0.07	NM	3.02	-34	NM	NM	6.3	
	7/21/11	23.84	-	-	-1.82	NM	2.26	32.1	NM	NM	6.0	
	8/17/11	22.19	-	-	-0.17	NM	2.88	9.0	NM	NM	6.2	
	9/22/11	21.08	-	-	0.94	NM	2.24	35.0	NM	NM	6.2	
	10/27/11	20.96	-	-	1.06	NM	NM	NM	NM	NM	NM	
	11/28/11	21.44	-	-	0.58	NM	2.57	83.00	NM	NM	6.99	
	12/21/11	21.23	-	-	0.79	17.31	9.77	73.7	0.25	NM	6.4	
	1/26/12	22.64	22.32	0.32	-0.38	NM	NM	NM	NM	NM	NM	
	2/29/12	21.99	21.60	0.39	0.32	NM	NM	NM	NM	NM	NM	
	3/16/12	22.11	21.70	0.41	0.22	NM	NM	NM	NM	NM	NM	
	4/6/12	22.25	21.97	0.28	-0.02	NM	NM	NM	NM	NM	NM	
	5/15/12	22.29	22.11	0.18	-0.14	NM	NM	NM	NM	NM	NM	
	6/14/12	22.29	22.28	0.01	-0.26	NM	NM	NM	NM	NM	NM	
	6/18/12	22.23	22.21	0.02	-0.20	NM	NM	NM	NM	NM	NM	
	7/16/12	22.50	22.00	0.50	-0.11	NM	6.60	142.10	NM	NM	5.72	
	8/8/12	23.00	22.55	0.45	-0.64	NM	1.76	-52.30	NM	NM	6.64	
	9/11/12	22.62	22.34	0.28	-0.39	NM	NM	NM	NM	NM	NM	
	11/27/12	22.49	22.41	0.08	-0.41	NM	NM	NM	NM	NM	NM	
	12/31/12	22.65	22.60	0.05	-0.59	NM	NM	NM	NM	NM	NM	
	1/17/13	22.61	22.13	0.48	-0.23	NM	NM	NM	NM	NM	NM	
	2/27/13	22.40	-	-	-0.38	NM	3.38	6.00	NM	NM	NM	
	4/26/13	22.56	-	-	-0.54	NM	0.91	-61.00	NM	NM	6.37	
	5/23/13	22.44	-	-	-0.42	NM	2.09	-80.00	NM	NM	6.43	
	6/18/13	22.61	22.11	0.50	-0.22	NM	NM	NM	NM	NM	NM	
	8/30/13	21.44	-	-	0.58	NM	3.66	-45.00	NM	NM	7.54	
	9/11/13	21.44	-	-	0.58	NM	9.86	35.40	NM	NM	6.26	
	9/30/13	21.61	-	-	0.41	NM	2.45	-61.70	NM	NM	6.53	
	10/24/13	21.86	-	-	0.16	NM	6.15	-2.80	NM	NM	6.52	
	11/26/13	22.16	-	-	-0.14	NM	1.51	-17.00	NM	NM	7.15	
	12/13/13	22.20	-	-	-0.18	NM	1.59	7.90	NM	NM	9.81	

**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-230	9/14/07	20.19	-	-	-	19.5	0.87	-113.00	NM	770	7.0	
	3/25/09	20.63	-	-	-0.44	NM	0.26	-105.9	NM	NM	NM	
	4/1/09	NM	-	-	NM	NM	1.58	-84	NM	NM	NM	
	4/15/09	NM	-	-	NM	NM	1.52	-69	NM	NM	NM	
	4/22/09	NM	-	-	NM	NM	1.78	-58	NM	NM	NM	
	5/7/09	18.70	-	-	1.49	NM	1.04	-79	NM	NM	NM	
	5/21/09	NM	-	-	NM	NM	1.21	NM	NM	NM	NM	
	6/4/09	NM	-	-	NM	NM	0.68	-71	NM	NM	NM	
	6/23/09	18.65	-	-	1.54	NM	0.64	-105	NM	NM	NM	
	7/8/09	19.62	-	-	0.57	NM	0.56	-126	NM	NM	6.4	
	7/21/09	19.78	-	-	0.41	NM	0.78	-51	NM	NM	5.9	
	8/4/09	19.29	-	-	0.90	NM	0.98	-111	NM	NM	6.7	
	8/19/09	19.65	-	-	0.54	NM	0.33	-142	NM	NM	6.9	
	9/9/09	19.32	-	-	0.87	NM	0.59	-125	NM	NM	6.7	
	9/16/09	18.81	-	-	1.38	NM	NM	NM	NM	NM	NM	
	9/23/09	19.09	-	-	1.10	NM	0.70	-106	NM	NM	6.7	
	10/7/09	20.36	-	-	-0.17	NM	0.92	-96	NM	NM	6.6	
	10/22/09	20.39	-	-	-0.20	NM	1.30	-97	NM	NM	6.7	
	11/25/09	19.29	-	-	0.90	NM	NM	NM	NM	NM	NM	
	12/2/09	20.92	-	-	-0.73	NM	2.07	-57	NM	NM	6.7	
	12/10/09	20.91	-	-	-0.72	NM	NM	NM	NM	319	NM	
	12/16/09	19.31	-	-	0.88	NM	5.00	0.6	NM	NM	7.0	
	12/30/09	18.89	-	-	1.30	NM	1.51	-32	NM	NM	6.9	
	1/14/10	20.27	-	-	-0.08	NM	2.62	-20	NM	NM	6.5	
	1/28/10	18.95	-	-	1.24	NM	3.55	-5	NM	NM	7.3	
	3/4/10	18.33	-	-	1.86	NM	3.03	-94	NM	NM	7.3	
	3/17/10	16.57	-	-	3.62	NM	NM	NM	NM	NM	NM	
	3/25/10	17.75	-	-	2.44	NM	3.74	16	NM	NM	6.9	
	4/15/10	19.02	-	-	1.17	NM	3.06	-99	NM	NM	7.1	
	4/29/10	17.97	-	-	2.22	NM	3.78	-66	NM	NM	7.2	
	5/20/10	17.97	-	-	2.22	NM	3.37	-67	NM	NM	7.7	
	6/1/10	20.07	-	-	0.12	NM	NM	NM	NM	296	NM	
	6/3/10	20.33	-	-	-0.14	NM	4.33	29	NM	NM	6.8	
	6/17/10	19.69	-	-	0.50	NM	3.36	-38	NM	NM	7.3	
	7/13/10	10.00	-	-	20.19	NM	5.45	27	NM	NM	6.8	
	7/29/10	18.95	-	-	1.24	NM	2.35	-80	NM	NM	9.0	
	8/12/10	20.20	-	-	-0.01	NM	2.37	-44	NM	NM	7.2	
	8/26/10	22.59	-	-	-2.40	NM	3.04	-46	NM	NM	8.0	
	9/9/10	22.61	-	-	-2.42	NM	9.40	24	NM	NM	8.9	
	9/23/10	22.88	-	-	-2.69	NM	2.39	-50	NM	NM	7.2	
	10/7/10	19.14	-	-	1.05	NM	4.05	3	NM	NM	6.7	
	10/28/10	20.09	-	-	0.10	NM	3.58	-2	NM	NM	7.3	
	11/9/10	19.60	-	-	0.59	NM	NM	NM	NM	NM	NM	
	11/12/10	20.61	-	-	-0.42	NM	3.52	26	NM	NM	6.9	
	11/23/10	20.30	-	-	-0.11	NM	3.65	-63	NM	NM	7.2	
	12/16/10	19.86	-	-	0.33	NM	4.47	11	NM	NM	6.6	
	12/30/10	20.76	-	-	-0.57	NM	4.78	35	NM	NM	7.3	
	1/14/11	20.92	-	-	-0.73	NM	3.67	35	NM	NM	6.7	
	2/10/11	17.66	-	-	2.53	NM	6.13	6	NM	NM	6.9	
	3/9/11	17.69	-	-	2.50	NM	4.39	-31	NM	NM	7.2	
	3/14/11	17.55	-	-	2.64	16.08	1.33	-26	0.807	NM	6.6	
	4/21/11	17.60	-	-	2.59	NM	4.94	-3.8	NM	NM	8.2	
	5/16/11	19.33	-	-	0.86	15.34	3.87	-20.7	0.422	NM	6.9	
	5/19/11	17.15	-	-	3.04	NM	4.18	60.0	NM	NM	5.6	
	6/16/11	19.95	-	-	0.24	NM	3.47	-8.0	NM	NM	6.4	
	7/21/11	20.38	-	-	-0.19	NM	1.88	5.2	NM	NM	5.8	
	8/17/11	17.97	-	-	2.22	NM	1.19	-5	NM	NM	6.7	
	9/22/11	18.63	-	-	1.56	NM	1.31	23	NM	NM	6.3	
	10/27/11	18.18	-	-	2.01	NM	NM	NM	NM	NM	NM	
	11/28/11	18.25	-	-	1.94	NM	1.33	74.00	NM	NM	6.8	
	12/21/11	18.67	-	-	1.52	18.23	4.04	30.6	0.23	NM	7.5	
	1/26/12	17.40	-	-	2.79	NM	1.63	-110.1	NM	NM	6.9	
	2/29/12	19.49	-	-	0.70	NM	6.63	63.0	NM	NM	6.5	
	3/16/12	20.16	-	-	0.03	NM	5.66	-8.9	NM	NM	7.1	
	4/6/12	20.48	-	-	-0.29	NM	6.75	19.5	NM	NM	7.4	
	5/15/12	21.02	-	-	-0.83	NM	6.08	-42.0	NM	NM	7.05	
	6/14/12	19.69	-	-	0.50	NM	0.98	-44.9	NM	NM	6.64	
	6/18/12	20.27	-	-	-0.08	20.05	1.99	-84.8	NM	NM	6.69	
	7/16/12	20.80	-	-	-0.61	NM	15.18	51.3	NM	NM	6.90	
	8/8/12	20.70	-	-	-0.51	NM	2.34	-51.40	NM	NM	7.07	
	9/11/12	20.80	-	-	-0.61	NM	17.13	48.70	NM	NM	6.81	
	11/27/12	19.70	-	-	0.49	NM	8.57	-21.60	NM	NM	6.91	
	12/31/12	20.35	-	-	-0.16	NM	10.97	31.80	NM	NM	7.04	
	1/17/13	20.34	-	-	-0.15	NM	2.25	12.20	NM	NM	6.76	
	2/27/13	20.34	-	-	-0.15	NM	7.84	81.00	NM	NM	NM	
	4/26/13	20.72	-	-	-0.53	NM	1.51	-67.00	NM	NM	6.40	
	5/23/13	20.88	-	-	-0.69	NM	1.53	58.00	NM	NM	6.48	
	6/18/13	20.37	-	-	-0.18	NM	0.99	-53.00	NM	NM	6.63	
	8/30/13	19.59	-	-	0.60	NM	0.88	-60.90	NM	NM	7.15	
	9/11/13	20.05	-	-	0.14	NM	1.83	19.00	NM	NM	6.58	
	9/30/13	20.22	-	-	-0.03	NM	1.68	-8.80	NM	NM	6.78	
	10/24/13	20.36	-	-	-0.17	NM	1.39	21.00	NM	NM	6.60	
	11/26/13	20.72	-	-	-0.53	NM	1.21	1.00	NM	NM	6.78	
	12/13/13	20.15	20.10	0.05	3.58	NM	1.59	7.90	NM	NM	9.81	

**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-231	9/14/07	19.94	-	-	-	-	20.30	0.65	-90.00	NM	2,958	6.8
	3/25/09	20.84	-	-	-0.90	NM	0.30	-106.5	NM	NM	NM	
	4/1/09	NM	-	-	NM	NM	1.22	-82	NM	NM	NM	
	4/15/09	NM	-	-	NM	NM	1.40	-41	NM	NM	NM	
	4/22/09	NM	-	-	NM	NM	3.45	2.0	NM	NM	NM	
	5/7/09	19.89	-	-	0.05	NM	0.32	-23	NM	4,935	3.1	
	5/21/09	NM	-	-	NM	NM	2.12	NM	NM	NM	NM	
	6/4/09	NM	-	-	NM	NM	1.01	-75	NM	NM	NM	
	6/22/09	19.22	-	-	0.72	NM	0.35	-99.5	1.410	301	6.51	
	7/8/09	20.04	-	-	-0.10	NM	0.51	-104	NM	NM	6.2	
	7/21/09	20.19	-	-	-0.25	NM	0.75	-72	NM	NM	5.9	
	8/4/09	20.15	-	-	-0.21	NM	1.08	-82	NM	NM	6.4	
	8/19/09	20.02	-	-	-0.08	NM	0.91	-100	NM	NM	6.5	
	9/9/09	19.76	-	-	0.18	NM	1.20	-78	NM	NM	6.4	
	9/16/09	19.66	-	-	0.28	19.70	0.42	-94.9	0.870	3,636	6.53	
	9/23/09	19.62	-	-	0.32	NM	0.84	-39	NM	NM	6.2	
	10/7/09	20.12	-	-	-0.18	NM	1.40	-58	NM	NM	6.2	
	10/22/09	20.47	-	-	-0.53	NM	0.66	-41	NM	NM	6.1	
	11/25/09	20.28	-	-	-0.34	NM	NM	NM	NM	NM	NM	
	12/2/09	20.40	-	-	-0.46	NM	1.11	-82	NM	NM	6.4	
	12/10/09	20.04	-	-	-0.10	17.16	0.83	-100.3	1.289	2,181	6.46	
	12/16/09	20.55	-	-	-0.61	NM	2.66	-33	NM	NM	6.2	
	12/30/09	20.18	-	-	-0.24	NM	1.10	-69	NM	NM	6.4	
	1/14/10	20.11	-	-	-0.17	NM	1.81	-68	NM	NM	6.1	
	1/28/10	20.04	-	-	-0.10	NM	1.71	-69	NM	NM	6.4	
	3/4/10	20.02	-	-	-0.08	NM	2.01	-66	NM	NM	6.5	
	3/17/10	19.84	-	-	0.10	20.31	0.10	-140	1.689	660	6.7	
	3/25/10	19.85	-	-	0.09	NM	2.24	-72	NM	NM	6.7	
	4/15/10	19.60	-	-	0.34	NM	1.20	-72	NM	NM	6.3	
	4/29/10	19.76	-	-	0.18	NM	1.68	-36	NM	NM	6.5	
	5/20/10	19.91	-	-	0.03	NM	1.63	-67	NM	NM	6.6	
	6/1/10	19.93	-	-	0.01	21.73	0.18	-111.4	1.616	427	6.7	
	6/3/10	19.94	-	-	0.00	NM	1.81	-20	NM	NM	6.4	
	6/17/10	20.04	-	-	-0.10	NM	1.97	-30	NM	NM	6.4	
	7/13/10	19.87	-	-	0.07	NM	0.98	-68	NM	NM	6.1	
	7/29/10	19.81	-	-	0.13	NM	3.27	28	NM	NM	6.9	
	8/12/10	19.95	-	-	-0.01	NM	1.71	-29	NM	NM	6.9	
	8/26/10	20.17	-	-	-0.23	NM	2.54	-18	NM	NM	7.1	
	9/9/10	20.17	-	-	-0.23	NM	3.50	-36	NM	NM	7.6	
	9/23/10	20.46	-	-	-0.52	NM	4.93	15	NM	NM	7.4	
	10/7/10	20.33	-	-	-0.39	NM	2.87	4	NM	NM	6.6	
	10/28/10	20.38	-	-	-0.44	NM	3.07	2	NM	NM	6.5	
	11/9/10	20.42	-	-	-0.48	NM	NM	NM	NM	NM	NM	
	11/12/10	20.55	-	-	-0.61	NM	4.15	46	NM	NM	6.1	
	11/23/10	20.38	-	-	-0.44	NM	2.39	-50	NM	NM	7.2	
	12/16/10	21.08	21.07	0.01	-1.13	NM	NM	NM	NM	NM	NM	
	12/30/10	20.81	20.80	0.01	-0.86	NM	NM	NM	NM	NM	NM	
	1/14/11	21.11	20.82	0.29	-0.95	NM	NM	NM	NM	NM	NM	
	2/10/11	20.79	20.24	0.55	-0.44	NM	NM	NM	NM	NM	NM	
	3/9/11	20.73	20.25	0.48	-0.43	NM	NM	NM	NM	NM	NM	
	3/14/11	20.13	-	-	-0.19	18.01	1.89	-27	2.56	NM	6.5	
	4/21/11	20.46	20.01	0.45	-0.18	NM	NM	NM	NM	NM	NM	
	5/16/11	19.98	19.92	0.06	0.00	NM	NM	NM	NM	NM	NM	
	5/19/11	20.40	20.02	0.38	-0.17	NM	NM	NM	NM	NM	NM	
	6/16/11	20.49	20.12	0.37	-0.27	NM	NM	NM	NM	NM	NM	
	7/21/11	20.61	20.29	0.32	-0.43	NM	NM	NM	NM	NM	NM	
	8/17/11	20.65	20.44	0.21	-0.55	NM	NM	NM	NM	NM	NM	
	9/22/11	19.36	19.21	0.15	0.69	NM	NM	NM	NM	NM	NM	
	10/27/11	-	-	-	-	NM	NM	NM	NM	NM	NM	
	11/28/11	19.91	19.73	0.18	0.17	NM	NM	NM	NM	NM	NM	
	12/21/11	19.60	19.46	0.14	0.45	NM	NM	NM	NM	NM	NM	
	1/26/12	19.66	19.52	0.14	0.39	NM	NM	NM	NM	NM	NM	
	2/29/12	20.01	19.89	0.12	0.02	NM	NM	NM	NM	NM	NM	
	3/16/12	19.83	19.76	0.07	0.16	NM	NM	NM	NM	NM	NM	
	6/18/12	20.60	20.49	0.11	-0.58	NS	NS	NS	NS	NS	NS	
	7/16/12	21.40	20.70	0.70	-0.93	NM	26.00	-70.3	NM	NM	6.61	
	8/8/12	21.20	20.90	0.30	-1.04	NM	NM	NM	NM	NM	NM	
	9/11/12	21.20	20.50	0.70	-0.73	NM	NM	NM	NM	NM	NM	
	11/27/12	20.74	20.66	0.08	-0.74	NM	NM	NM	NM	NM	NM	
	12/31/12	20.90	20.88	0.02	-0.94	NM	NM	NM	NM	NM	NM	
	1/17/13	21.42	21.18	0.24	-1.30	NM	NM	NM	NM	NM	NM	
	2/27/13	20.56	-	-	-0.62	NM	3.52	26.00	NM	NM	NM	
	4/26/13	20.75	-	-	-0.81	NM	0.65	-62.00	NM	NM	6.19	
	5/23/13	20.69	-	-	-0.75	NM	2.47	-65.00	NM	NM	6.27	
	6/18/13	20.13	-	-	-0.19	NM	0.95	-39.00	NM	NM	6.39	
	8/30/13	19.65	19.64	0.01	0.30	NM	NM	NM	NM	NM	NM	
	9/11/13	19.74	-	-	0.20	NM	3.04	-31.70	NM	NM	6.47	
	9/30/13	19.90	-	-	0.04	NM	1.65	-73.00	NM	NM	6.62	
	10/24/13	20.11	-	-	-0.17	NM	1.08	10.00	NM	NM	6.49	
	11/26/13	20.52	-	-	-0.58	NM	1.14	-12.00	NM	NM	6.65	
	12/13/13	21.45	-	-	-1.51	NM	4.99	76.10	NM	NM	11.36	

**TABLE 2**  
**Field Measurements**  
**26th Street South Area (AOI-1)**  
**Sunoco, Inc. Philadelphia Refinery**



Well ID	Sample Date	Casing Elev (feet)	DTW	DTP	Prod. Thickness	GW Elev	Temp (°C)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	CO2 (ppm) (@10 sec.)	pH
S-232	9/14/07	20.31	-	-	-	NM	NM	NM	NM	NM	NM	NM
	3/25/09	21.55	-	-	-1.24	NM	0.20	-110.1	NM	NM	NM	NM
	4/1/09	NM	-	-	NM	NM	27.30	23	NM	NM	NM	NM
	4/15/09	NM	-	-	NM	NM	26.11	28	NM	NM	NM	NM
	4/22/09	NM	-	-	NM	NM	13.85	147	NM	NM	NM	NM
	5/7/09	20.69	-	-	-0.38	NM	11.09	284	NM	563	3.0	
	5/21/09	NM	-	-	NM	NM	9.12	NM	NM	NM	NM	NM
	6/4/09	NM	-	-	NM	NM	19.90	43	NM	NM	NM	NM
	6/22/09	20.46	-	-	-0.15	NM	6.25	31.5	1.781	271	6.38	
	7/8/09	21.01	-	-	-0.70	NM	31.02	3	NM	NM	6.8	
	7/21/09	21.02	-	-	-0.71	NM	30.97	0.2	NM	NM	6.4	
	8/4/09	20.80	-	-	-0.49	NM	22.51	-15	NM	NM	6.5	
	8/19/09	20.89	-	-	-0.58	NM	21.02	29	NM	NM	6.6	
	9/9/09	20.34	-	-	-0.03	NM	12.15	-12	NM	NM	6.5	
	9/16/09	19.55	-	-	0.76	19.41	0.61	1.3	1.710	723	6.55	
	9/23/09	20.23	-	-	0.08	NM	17.10	0.0	NM	NM	6.6	
	10/7/09	20.59	-	-	-0.28	NM	22.80	-20.0	NM	NM	6.6	
	10/22/09	20.58	-	-	-0.27	NM	13.96	-24.0	NM	NM	6.5	
	11/25/09	20.67	-	-	-0.36	NM	NM	NM	NM	NM	NM	
	12/2/09	20.99	-	-	-0.68	NM	28.17	-41	NM	NM	6.9	
	12/10/09	20.07	-	-	0.24	18.35	26.58	56.70	1.667	369	6.80	
	12/16/09	20.87	-	-	-0.56	NM	29.42	5	NM	NM	6.8	
	12/30/09	20.72	-	-	-0.41	NM	23.33	-35	NM	NM	6.7	
	1/14/10	24.84	-	-	-4.53	NM	22.85	95	NM	NM	6.4	
	1/28/10	20.61	-	-	-0.30	NM	29.63	14	NM	NM	6.9	
	3/4/10	20.60	-	-	-0.29	NM	22.91	9	NM	NM	6.8	
	3/17/10	20.22	-	-	0.09	20.54	1.65	34	1.92	2,397	6.6	
	3/25/10	20.25	-	-	0.06	NM	2.49	22	NM	NM	6.7	
	4/15/10	20.11	-	-	0.20	NM	2.81	-4	NM	NM	6.7	
	4/29/10	20.25	-	-	0.06	NM	1.84	-29	NM	NM	6.7	
	5/20/10	20.48	-	-	-0.17	NM	2.84	-20	NM	NM	6.9	
	6/1/10	19.44	-	-	0.87	22.22	0.66	-37.8	2.116	368	6.8	
	6/3/10	20.51	-	-	-0.20	NM	3.05	-22	NM	NM	6.6	
	6/17/10	20.71	-	-	-0.40	NM	10.29	30	NM	NM	6.8	
	7/13/10	19.40	-	-	0.91	NM	1.31	-86	NM	NM	6.5	
	7/29/10	19.45	-	-	0.86	NM	4.01	23	NM	NM	6.9	
	8/12/10	19.65	-	-	0.66	NM	1.99	-38	NM	NM	7.5	
	8/26/10	19.82	-	-	0.49	NM	2.18	20	NM	NM	6.9	
	9/9/10	20.18	-	-	0.13	NM	6.35	-23	NM	NM	7.7	
	9/23/10	21.10	-	-	-0.79	NM	2.97	35	NM	NM	6.7	
	10/7/10	20.97	-	-	-0.66	NM	2.35	35	NM	NM	6.3	
	10/28/10	21.00	-	-	-0.69	NM	18.36	16	NM	NM	6.5	
	11/9/10	21.18	-	-	-0.87	NM	NM	NM	NM	NM	NM	
	11/12/10	21.31	-	-	-1.00	NM	12.22	36	NM	NM	6.3	
	11/23/10	21.04	-	-	-0.73	NM	9.05	-17	NM	NM	6.5	
	12/16/10	21.47	-	-	-1.16	NM	5.46	61	NM	NM	6.3	
	12/30/10	21.60	-	-	-1.29	NM	3.97	69	NM	NM	6.7	
	1/14/11	21.65	-	-	-1.34	NM	3.24	7	NM	NM	6.5	
	2/10/11	21.18	-	-	-0.87	NM	4.56	35	NM	NM	6.7	
	3/9/11	21.01	-	-	-0.70	NM	3.64	15	NM	NM	6.6	
	3/14/11	20.75	-	-	-0.44	19.11	1.39	-43	1.07	NM	6.8	
	4/21/11	20.64	-	-	-0.33	NM	5.83	13	NM	NM	6.9	
	5/16/11	20.89	-	-	-0.58	19.03	3.32	-5	0.53	NM	6.7	
	5/19/11	20.94	-	-	-0.63	NM	2.28	-20	NM	NM	6.4	
	6/16/11	21.04	-	-	-0.73	NM	2.09	-20	NM	NM	6.7	
	7/21/11	21.17	-	-	-0.86	NM	1.65	4.9	NM	NM	5.8	
	8/17/11	21.27	-	-	-0.96	NM	1.34	45	NM	NM	5.3	
	9/22/11	20.12	-	-	0.19	NM	0.94	26.0	NM	NM	5.9	
	10/27/11	-	-	-	-	NM	NM	NM	NM	NM	NM	
	11/28/11	20.28	-	-	1.74	NM	2.79	64.00	NM	NM	6.29	
	12/21/11	19.79	-	-	2.23	20.57	4.15	8.1	0.37	NM	7.7	
	1/26/12	20.00	-	-	2.02	NM	1.58	-163.4	0.37	NM	6.7	
	2/29/12	19.61	19.58	0.03	0.72	NM	NM	NM	NM	NM	NM	
	3/16/12	20.16	-	-	0.15	NM	3.77	-3.9	NM	NM	7.0	
	4/6/12	20.91	-	-	-0.60	NM	3.14	12.8	NM	NM	7.30	
	5/15/12	20.03	-	-	0.28	NM	6.42	-49.8	NM	NM	7.25	
	6/14/12	21.31	-	-	-1.00	NM	0.81	-18.3	NM	NM	6.64	
	6/18/12	21.34	-	-	-1.03	21.31	1.76	-90.8	NM	NM	6.8	
	7/16/12	21.70	21.60	0.10	-1.32	NM	1.17	-102.1	NM	NM	6.53	
	8/8/12	21.50	-	-	-1.19	NM	1.54	-58.3	NM	NM	6.47	
	9/11/12	22.10	-	-	-1.79	NM	1.28	-101.3	NM	NM	7.01	
	11/27/12	20.82	-	-	-0.51	NM	7.08	6.7	NM	NM	6.61	
	12/31/12	21.09	-	-	-0.78	NM	11.10	9.5	NM	NM	6.84	
	1/17/13	21.44	-	-	-1.13	NM	0.98	12.4	NM	NM	6.66	
	2/27/13	20.41	-	-	-0.10	NM	5.16	31.0	NM	NM	NM	
	4/26/13	21.04	-	-	-0.73	NM	1.14	-96.0	NM	NM	6.49	
	5/23/13	21.28	-	-	-0.97	NM	1.85	-33.0	NM	NM	6.22	
	6/18/13	20.50	-	-	-0.19	NM	0.87	-58.0	NM	NM	6.67	
	8/30/13	20.09	-	-	0.22	NM	0.20	-40.9	NM	NM	6.84	
	9/11/13	19.94	-	-	0.37	NM	0.73	-139.0	NM	NM	6.84	
	9/30/13	20.35	-	-	-0.04	NM	3.41	-60.8	NM	NM	6.73	
	10/24/13	20.59	-	-	-0.28	NM	2.05	4.00	NM	NM	6.68	
	11/26/13	21.07	-	-	-0.76	NM	0.90	-27.00	NM	NM	6.70	
	12/13/13	21.25	-	-	-0.94	NM	5.75	133.40	NM	NM	9.36	

DTW = depth to water (measured from top of inner casing); DTP = depth to product if present (measured from top of inner casing)

Total Depth = Depth to bottom of well (measured from top of inner casing)

Some measurements collected on a monthly basis as part of performance monitoring and some on a quarterly basis as part of quarterly sampling program.

Note: If Readings from O&M and GW sampling occurred on same day (or within a day), the GW Sampling reading was tabulated.

Note that DO during GW sampling is consistently lower than 'grab' samples done during O&M.

System shut down on 11-13-09 due to paving activities; restarted on 11-18-09. (switched injection to shallow points except deep injection at IP-17, 18 & 19).

Could not read 17th Street points on 11/25/09 due to continued paving in roadway. During February visits could not check wells due to amount of snow.

† - depth to water was 0.0 (at surface) most likely due to surface run off entering well.

\*Measurement assumed to be erroneously high - well regauged two days later and confirmed with bailer to be closer to second reading.

TABLE 3a

**SUNOCO-PHILADELPHIA REFINERY, 26TH STREET (AOI-1)**  
**SUMMARY OF OXYGEN INJECTION REMEDIATION SYSTEM DO FIELD DATA**  
**SHALLOW WELLS ONLY**



DATE	IW-1S	IW-2S	IW-3S	IW-4S	IW-5S	IW-6S	IW-7S	IW-8S	IW-9S	IW-10S	IW-11S	IW-12S	IW-13S	IW-14S	IW-15S	IW-16S	IW-17S	IW-18S	IW-19S	IW-20S	IW-21S	IW-22S	IW-23S	IW-24S	IW-25S	IW-26S	IW-27S	
25-Mar-09	4.36	3.89	3.16	2.79	1.86	1.82	1.31	1.79	1.87	1.92	1.14	1.47	1.79	1.05	0.22	1.33	0.25	0.23	0.22	2.13	0.16	0.18	0.26	0.43	1.53	0.22	0.29	
8-Apr-09	7.20	16.01	3.83	14.01	3.13	13.06	5.27	7.28	20.70	22.72	9.54	25.11	3.36	29.35	4.05	29.26	21.86	38.92	26.06	34.60	5.20	23.00	12.31	3.31	22.87	28.10	2.74	
15-Apr-09	4.92	27.80	NM-I	25.37	4.98	25.11	4.09	22.85	33.58	5.38	3.31	32.20	3.50	33.33	3.36	NM												
22-Apr-09	NM	NM	NM	NM	NM	30.51	33.04	30.53	33.55	22.48	25.58	47.03	53.05	4.02	49.87	32.17	3.85											
06-May-09	35.15	NM	3.21	NM	3.05	NM	2.15	NM	39.31	NM	13.28	NM	5.30	NM	3.23	NM	36.66	NM	37.73	NM	10.44	NM	37.92	NM	39.58	NM	3.97	
21-May-09	NM	5.72	NM	28.50	NM	35.16	NM	36.28	NM	16.52	NM	36.96	NM	39.07	NM	37.80	NM	36.44	NM	37.20	NM	38.44	NM	4.55	NM	36.11	NM	
04-Jun-09	31.45	NM	3.10	NM	2.28	NM	2.17	NM	37.82	NM	1.82	NM	15.82	NM	2.45	NM	26.71	NM	33.80	NM	15.64	NM	27.38	NM	27.27	NM	2.61	
23-Jun-09	NM	17.66	NM	19.85	NM	15.39	NM	17.36	NM	7.01	NM	24.88	NM	26.16	NM	26.26	NM	26.85	NM	15.84	NM	29.20	NM	2.66	NM	20.35	NM	
08-Jul-09	34.40	NM	2.29	NM	2.68	NM	3.56	NM	32.86	NM	3.19	NM	36.09	NM	2.78	NM	33.70	NM	32.20	NM	18.92	NM	36.01	NM	34.93	NM	32.52	
21-Jul-09	NM	17.40	NM	34.70	NM	34.84	NM	30.71	NM	17.53	NM	36.34	NM	33.27	NM	31.70	NM	31.08	NM	31.78	NM	35.03	NM	3.30	NM	31.88	NM	
04-Aug-09	6.00	NM	35.25	NM	2.65	NM	3.98	NM	34.53	NM	2.55	NM	34.88	NM	2.19	NM	30.75	NM	30.18	NM	3.79	NM	34.71	NM	32.41	NM	31.32	
19-Aug-09	NM	15.09	NM	37.85	NM	42.38	NM	25.54	NM	19.52	NM	14.10	NM	10.79	NM	19.51	NM	18.37	NM	31.71	NM	32.96	NM	14.95	NM	36.20	NM	
09-Sep-09	35.96	NM	2.91	NM	3.29	NM	6.62	NM	33.46	NM	2.75	NM	34.35	NM	4.70	NM	25.81	NM	28.01	NM	25.20	NM	34.04	NM	15.45	NM	27.52	
23-Sep-09	NM	19.22	NM	33.26	NM	34.42	NM	32.01	NM	20.61	NM	35.33	NM	33.13	NM	35.51	NM	31.82	NM	34.40	NM	29.11	NM	NM	NM	36.01	NM	
7-Oct-09	36.22	NM	2.45	NM	3.99	NM	9.16	NM	30.88	NM	2.88	NM	32.76	NM	2.74	NM	31.10	NM	27.40	NM	28.48	NM	29.63	NM	38.48	NM	36.66	
21-Oct-09	NM	25.01	NM	35.52	NM	32.69	NM	22.04	NM	30.39	NM	32.23	NM	31.87	NM	30.65	NM	28.18	NM	33.27	NM	4.11	NM	34.18	NM	NM		
18-Nov-09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	26.08	NM	27.40	NM	25.77	NM	24.55	30.33	30.04									
2-Dec-09	29.94	NM	35.28	NM	34.80	NM	26.95	NM	33.11	NM	17.10	NM	25.85	NM	31.51	NM	33.16	NM	31.08	NM	25.86	NM	30.80	NM	19.71	NM	17.56	
16-Dec-09	NM	35.58	NM	20.27	NM	27.61	NM	23.17	NM	29.90	NM	6.36	NM	34.37	NM	33.99	NM	36.55	NM	32.80	NM	29.80	NM	30.90	NM	31.49	NM	
30-Dec-09	36.39	NM	36.95	NM	35.10	NM	28.08	NM	28.21	NM	7.43	NM	26.76	NM	29.37	NM	30.42	NM	33.96	NM	27.63	NM	34.00	NM	10.13	NM	35.23	
14-Jan-10	NM	30.84	NM	33.33	NM	25.93	NM	22.00	NM	28.87	NM	24.38	NM	27.80	NM	25.96	NM	28.52	NM	26.19	NM	22.70	NM	22.94	NM	18.27	NM	
28-Jan-10	36.39	NM	36.14	NM	31.92	NM	24.88	NM	28.86	NM	3.85	NM	25.56	NM	30.07	NM	32.33	NM	30.57	NM	24.21	NM	33.58	NM	32.97	NM	32.73	
4-Mar-10	36.87	NM	42.25	NM	39.58	NM	20.84	NM	31.50	NM	5.46	NM	26.06	NM	30.77	NM	33.16	NM	32.19	NM	19.38	NM	33.53	NM	37.81	NM	34.69	
25-Mar-10	NM	29.48	NM	25.73	NM	28.75	NM	25.08	NM	32.64	NM	7.05	NM	32.62	NM	31.78	NM	33.23	NM	31.38	NM	21.14	NM	27.63	NM	33.64	NM	
15-Apr-10	34.83	NM	35.04	NM	36.13	NM	18.88	NM	28.83	NM	5.18	NM	25.65	NM	29.42	NM	32.08	NM	29.33	NM	22.57	NM	34.50	NM	32.86	NM	30.30	
29-Apr-10	NM	31.49	NM	31.25	NM	37.24	NM	28.91	NM	35.93	NM	5.14	NM	33.98	NM	30.06	NM	32.64	NM	29.36	NM	29.08	NM	29.91	NM	33.95	NM	
20-May-10	30.70	NM	34.42	NM	35.40	NM	14.41	NM	27.67	NM	5.85	NM	24.98	NM	34.76	NM	32.28	NM	26.19	NM	30.64	NM	34.11	NM	28.66			
3-Jun-10	NM	30.24	NM	32.34	NM	35.26	NM	27.27	NM	32.38	NM	4.24	NM	8.91	NM	26.94	NM	32.44	NM	27.60	NM	23.73	NM	28.09	NM	32.71	NM	
17-Jun-10	32.86	NM	34.43	NM	34.96	NM	39.16	NM	28.41	NM	6.73	NM	21.67	NM	29.58	NM	33.56	NM	29.69	NM	28.41	NM	29.78	NM	34.66	NM	28.44	
13-Jul-10	NM	NM	NM	NM	NM	NM	28.11	NM	19.43	NM	3.96	NM	8.25	NM	28.49	NM	30.13	NM	29.57	NM								

TABLE 3b

**SUNOCO-PHILADELPHIA REFINERY, 26TH STREET (AOI-1)**  
**SUMMARY OF OXYGEN INJECTION REMEDIATION SYSTEM DO FIELD DATA**  
**DEEP WELLS ONLY**



DATE	IW-1D	IW-2D	IW-3D	IW-4D	IW-5D	IW-6D	IW-7D	IW-8D	IW-9D	IW-10D	IW-11D	IW-12D	IW-13D	IW-14D	IW-15D	IW-16D	IW-17D	IW-18D	IW-19D	IW-20D	IW-21D	IW-22D	IW-23D	IW-24D	IW-25D	IW-26D	IW-27D
25-Mar-09	7.04	2.13	2.28	2.77	1.93	2.07	0.38	1.89	1.45	2.01	1.66	1.6	1.68	2.31	0.25	1.44	0.99	0.22	1.43	1.94	1.51	0.2	0.25	1.72	NM	0.2	1.37
08-Apr-09	12.56	13.02	14.23	2.77	13.94	13.65	15.48	26.26	18.66	31.27	29.02	18.20	12.48	18.94	35.51	30.10	14.98	19.89	19.90	15.50	20.20	6.88	22.91	16.08	30.94	10.57	14.87
15-Apr-09	15.52	30.24	NM-I	2.79	35.98	33.70	33.62	30.46	32.95	37.01	32.73	32.65	13.01	34.17	36.50	NM											
22-Apr-09	NM	NM	NM	NM	NM	30.70	13.76	15.55	28.10	19.52	41.07	12.10	54.80	48.13	47.11	13.65	49.40										
06-May-09	12.73	NM	27.80	NM	37.48	NM	33.88	NM	37.94	NM	41.28	NM	17.77	NM	38.12	NM	21.37	NM	34.62	NM	31.42	NM	34.88	NM	42.54	NM	34.15
21-May-09	NM	39.77	NM	3.23	NM	40.11	NM	37.81	NM	39.50	NM	36.11	NM	34.80	NM	27.56	NM	27.47	NM	26.32	NM	26.77	NM	39.30	NM	13.33	NM
04-Jun-09	5.40	NM	33.77	NM	32.94	NM	31.78	NM	31.01	NM	37.32	NM	28.55	NM	29.82	NM	16.85	NM	29.60	NM	28.65	NM	26.73	NM	30.75	NM	26.23
23-Jun-09	NM	25.50	NM	2.84	NM	21.25	NM	25.66	NM	26.51	NM	21.54	NM	19.74	NM	29.71	NM	13.85	NM	11.86	NM	16.91	NM	22.56	NM	16.25	NM
08-Jul-09	12.74	NM	39.12	NM	33.94	NM	36.58	NM	34.91	NM	41.18	NM	34.88	NM	37.54	NM	32.78	NM	34.12	NM	30.98	NM	32.68	NM	39.62	NM	34.55
21-Jul-09	NM	37.54	NM	4.29	NM	40.77	NM	36.37	NM	42.90	NM	37.60	NM	35.80	NM	38.77	NM	27.27	NM	31.50	NM	33.10	NM	36.91	NM	32.55	NM
04-Aug-09	34.08	NM	1.64	NM	39.06	NM	34.53	NM	37.98	NM	41.07	NM	31.55	NM	33.21	NM	24.30	NM	36.36	NM	33.34	NM	30.80	NM	42.22	NM	37.15
19-Aug-09	NM	40.53	NM	2.50	NM	42.12	NM	40.80	NM	44.36	NM	17.30	NM	6.49	NM	10.20	NM	19.24	NM	41.83	NM	26.00	NM	46.01	NM	18.29	NM
09-Sep-09	5.30	NM	38.38	NM	33.68	NM	35.64	NM	33.32	NM	35.77	NM	31.87	NM	35.35	NM	29.70	NM	31.75	NM	33.11	NM	33.26	NM	38.00	NM	33.80
23-Sep-09	NM	37.40	NM	2.90	NM	33.92	NM	34.57	NM	35.58	NM	34.34	NM	33.50	NM	33.96	NM	31.67	NM	27.31	NM	26.61	NM	38.13	NM	23.25	NM
7-Oct-09	5.25	NM	38.12	NM	39.72	NM	36.71	NM	36.82	NM	34.62	NM	33.44	NM	35.01	NM	30.03	NM	33.61	NM	30.66	NM	28.75	NM	38.06	NM	36.42
21-Oct-09	NM	36.16	NM	2.96	NM	35.50	NM	35.63	NM	35.89	NM	36.17	NM	35.23	NM	32.60	NM	30.18	NM	30.66	NM	17.38	NM	37.22	NM	18.17	NM
18-Nov-09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	15.71	27.72	33.91	35.67	16.02	31.73									
2-Dec-09	29.75	NM	29.51	NM	25.88	NM	37.00	NM	29.18	NM	30.96	NM	27.51	NM	31.03	NM	31.11	NM	32.72	NM	24.02	NM	24.01	NM	33.56	NM	30.58
16-Dec-09	NM	21.56	NM	41.41	NM	22.92	NM	24.44	NM	37.15	NM	19.29	NM	21.75	NM	16.73	NM	36.29	NM	19.50	NM	7.00	NM	31.72	NM	7.85	NM
30-Dec-09	16.78	NM	26.99	NM	22.91	NM	36.31	NM	23.07	NM	26.77	NM	22.11	NM	28.73	NM	33.70	NM	36.53	NM	15.08	NM	20.71	NM	25.54	NM	28.33
14-Jan-10	NM	11.81	NM	24.54	NM	22.02	NM	16.77	NM	23.15	NM	9.80	NM	10.20	NM	5.84	NM	29.29	NM	10.17	NM	5.57	NM	24.46	NM	3.91	NM
28-Jan-10	12.31	NM	17.66	NM	18.66	NM	35.30	NM	20.81	NM	22.44	NM	17.63	NM	24.58	NM	30.62	NM	34.90	NM	7.77	NM	7.02	NM	38.37	NM	24.51
4-Mar-10	11.12	NM	12.69	NM	5.28	NM	36.15	NM	16.77	NM	17.95	NM	11.72	NM	22.46	NM	35.95	NM	36.74	NM	8.74	NM	5.64	NM	44.14	NM	18.40
25-Mar-10	NM	9.12	NM	21.28	NM	15.05	NM	18.55	NM	20.46	NM	6.70	NM	12.31	NM	4.21	NM	31.51	NM	9.06	NM	10.21	NM	21.45	NM	11.44	NM
15-Apr-10	12.66	NM	11.91	NM	7.73	NM	34.11	NM	13.66	NM	16.07	NM	8.84	NM	17.38	NM	28.24	NM	32.42	NM	5.52	NM	5.84	NM	38.12	NM	15.17
29-Apr-10	NM	5.86	NM	15.39	NM	14.48	NM	16.40	NM	19.59	NM	3.66	NM	8.44	NM	3.47	NM	31.69	NM	11.08	NM	5.70	NM	19.96	NM	9.36	NM
20-May-10	7.53	NM	8.88	NM	5.03	NM	34.40	NM	16.12	NM	12.58	NM	6.37	NM	13.55	NM	32.97	NM	29.75	NM	4.27	NM	7.03	NM	39.17	NM	10.69
3-Jun-10	NM	7.25	NM	10.32	NM	12.25	NM	15.34	NM	18.05	NM	3.97	NM	30.29	NM	3.25	NM	30.08	NM	8.05	NM	5.58	NM	15.31	NM	4.93	NM
17-Jun-10	7.77	NM	6.53	NM	6.28	NM	26.71	NM	14.02	NM	10.05	NM	3.52	NM	11.63	NM	30.33	NM	35.01	NM	3.70	NM	6.02	NM	38.61	NM	6.67
13-Jul-10	NM	7.43	NM	11.15	NM	4.92	NM	32.57	NM	2.																	

TABLE 4a

**SUNOCO-PHILADELPHIA REFINERY, 26TH STREET (AOI-1)**  
**SUMMARY OF OXYGEN INJECTION REMEDIATION SYSTEM ORP FIELD DATA**  
**SHALLOW WELLS ONLY**



DATE	IW-1S	IW-2S	IW-3S	IW-4S	IW-5S	IW-6S	IW-7S	IW-8S	IW-9S	IW-10S	IW-11S	IW-12S	IW-13S	IW-14S	IW-15S	IW-16S	IW-17S	IW-18S	IW-19S	IW-20S	IW-21S	IW-22S	IW-23S	IW-24S	IW-25S	IW-26S	IW-27S	
25-Mar-09	16	-183	-126	-262	-102	-11	-47	-71	-27	-74	-20	-193	-135	-127	-148	-169	-183	-180	-174	-182	-221	-150	-162	-239	-213	166	-121	
8-Apr-09	-88	-43	141	272	-4	309	205	104	316	206	81	325	1	292	116	297	287	299	294	368	125	257	219	32	240	269	78	
15-Apr-09	-5	-20	NM-I	64	-77	34	-24	51	69	24	-1	56	-1	64	3.36	NM	NM											
22-Apr-09	NM	NM	NM	NM	NM	47	57	45	87	83	112	24	51	-43	32	33	-50	NM										
6-May-09	69	NM	157	NM	-68	NM	17	NM	286	NM	-14	NM	153	NM	-51	NM	270	NM	296	NM	319	NM	312	NM	316	NM	-2	
21-May-09	NM	5.72	NM	NM	NM	NM	37.8	NM																				
4-Jun-09	29	NM	-81	NM	-116	NM	-89	NM	110	NM	-88	NM	96	NM	-86	NM	55	NM	70	NM	23	NM	116	NM	153	NM	-4	
23-Jun-09	NM	-105	NM	123	NM	144	NM	145	NM	165	NM	165	NM	127	NM	36	NM	40	NM	70	NM	115	NM	-114	NM	40	NM	
8-Jul-09	-23	NM	-116	NM	-105	NM	-61	NM	48	NM	-94	NM	35	NM	-74	NM	26	NM	47	NM	30	NM	94	NM	84	NM	99	
22-Jul-09	NM	-120	NM	68	NM	90	NM	84	NM	105	NM	92	NM	21	NM	51	NM	64	NM	53	NM	-3	NM	-89	NM	-5	NM	
4-Aug-09	-150	NM	-41	NM	-114	NM	-101	NM	-17	NM	-100	NM	8	NM	-97	NM	13	NM	-5	NM	-22	NM	-4	NM	28	NM	52	
19-Aug-09	NM	-119	NM	13	NM	51	NM	51	NM	80	NM	54	NM	27	NM	53	NM	46	NM	52	NM	35	NM	-91	NM	9	NM	
9-Sep-09	13	NM	-105	NM	-100	NM	-65	NM	58	NM	-92	NM	27	NM	-79	NM	0	NM	18	NM	58	NM	42	NM	47	NM	75	
23-Sep-09	NM	-94	NM	30	NM	86	NM	113	NM	135	NM	129	NM	30	NM	49	NM	40	NM	8	NM	48	NM	-72	NM	14	NM	
7-Oct-09	-33	NM	-141	NM	-90	NM	-60	NM	23	NM	-75	NM	34	NM	-75	NM	-3	NM	20	NM	28	NM	30	NM	42	NM	78	
21-Oct-09	NM	-98	NM	-66	NM	36	NM	74	NM	103	NM	116	NM	4	NM	25	NM	46	NM	52	NM	3	NM	-70	NM	36	NM	
18-Nov-09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	5	52	75	67	-5	61											
2-Dec-09	-6	NM	30	NM	8	NM	40	NM	69	NM	31	NM	52	NM	51	NM	68	NM	77	NM	79	NM	84	NM	92	NM	80	
16-Dec-09	NM	103	NM	108	NM	22	NM	-4	NM	42	NM	42	NM	401	NM	7	NM	11	NM	50	NM	0	NM	24	NM	68	NM	
30-Dec-09	-22	NM	23	NM	42	NM	62	NM	47	NM	-44	NM	46	NM	24	NM	37	NM	47	NM	45	NM	34	NM	46	NM	73	
14-Jan-10	NM	53	NM	107	NM	123	NM	58	NM	82	NM	117	NM	478	NM	139	NM	120	NM	146	NM	55	NM	72	NM	100	NM	
28-Jan-10	39	NM	76	NM	-49	NM	30	NM	52	NM	-36	NM	76	NM	3	NM	37	NM	48	NM	26	NM	36	NM	46	NM	70	
4-Mar-10	5	NM	65	NM	82	NM	-6	NM	47	NM	-22	NM	61	NM	3	NM	36	NM	29	NM	14	NM	17	NM	26	NM	61	
25-Mar-10	NM	-19	NM	37	NM	38	NM	15	NM	-21	NM	8	NM	306	NM	140	NM	120	NM	127	NM	3	NM	13	NM	43	NM	
15-Apr-10	17	NM	68	NM	64	NM	84	NM	2	NM	-35	NM	58	NM	-11	NM	27	NM	43	NM	-20	NM	15	NM	10	NM	30	
29-Apr-10	NM	-8	NM	29	NM	37	NM	-2	NM	18	NM	-8	NM	227	NM	-3	NM	13	NM	28	NM	-12	NM	-1	NM	23	NM	
20-May-10	4	NM	47	NM	58	NM	68	NM	7	NM	-55	NM	24	NM	4	NM	-12	NM	-4	NM	-33	NM	-26	NM	4	NM	42	
3-Jun-10	NM	-14	NM	8	NM	21	NM	21	NM	17	NM	-11	NM	102	NM	-26	NM	-12	NM	8	NM	-24	NM	-26	NM	-22	NM	
17-Jun-10	8	NM	59	NM	60	NM	80	NM	-3	NM	-31	NM	6	NM	-24	NM	5	NM	15	NM	-49	NM	-13	NM	-15	NM	18	
13-Jul-10	NM	NM	NM	NM	98	NM	48	NM	76	NM	62	NM	30	NM	60	NM	35	NM										
29-Jul-10	-80	NM	-28	NM	-21	NM	-4	NM	11	NM	16	NM	28	NM	-2	NM	20	NM	15	NM	9	NM	23	NM	48	NM	35	
12-Aug-10	NM	27	NM	31	NM	39	NM	52	NM	54	NM	37	NM	71	NM	92	NM	85	NM	62	NM	55	NM	57	NM	55	NM	
26-Aug-10	-15	NM	13	NM	13	NM	37	NM	25	NM	25	NM	4	NM	8	NM	26	NM	28	NM	26	NM	31	NM	39	NM	45	
9-Sep-10	NM	-12	NM	3	NM	9	NM	19	NM	34	NM	34	NM	42	NM	24	NM	25	NM	35	NM	38	NM	42	NM	37	NM	
23-Sep-10	-25	NM	-9	NM	-10	NM	15	NM	4	NM	4	NM	5	NM	16	NM	30	NM	24	NM	23	NM	29	NM	39	NM	31	
7-Oct-10	NM	7	NM	14	NM	10	NM	11	NM	14	NM	0	NM	23</td														

TABLE 4b

**SUNOCO-PHILADELPHIA REFINERY, 26TH STREET (AOI-1)**  
**SUMMARY OF OXYGEN INJECTION REMEDIATION SYSTEM ORP FIELD DATA**  
**DEEP WELLS ONLY**



DATE	IW-1D	IW-2D	IW-3D	IW-4D	IW-5D	IW-6D	IW-7D	IW-8D	IW-9D	IW-10D	IW-11D	IW-12D	IW-13D	IW-14D	IW-15D	IW-16D	IW-17D	IW-18D	IW-19D	IW-20D	IW-21D	IW-22D	IW-23D	IW-24D	IW-25D	IW-26D	IW-27D	
25-Mar-09	-43	-91	-105	-218	-153	-75	-8	-83	-53	-145	-27	-148	-160	-124	-126	-172	-186	-179	-170	-231	-144	-151	-164	-203	-182	-144	-33	
8-Apr-09	-58	139	167	24	292	262	353	320	325	323	311	288	292	301	352	317	201	245	282	211	334	162	280	268	304.8	255	322	
15-Apr-09	5	21	NM-I	29	66	3	11	40	55	48	8	41	40	26	NM	NM												
22-Apr-09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM										
6-May-09	29	NM	189	NM	188	NM	290	NM	277	NM	302	NM	284	NM	251	NM	228	NM	307	NM	336	NM	317	NM	276	NM	341	
21-May-09	NM	39.77	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM								
4-Jun-09	-120	NM	109	NM	55	NM	42	NM	100	NM	110	NM	54	NM	80	NM	34	NM	29.6	NM	74	NM	135	NM	138	NM	185	
23-Jun-09	NM	48	NM	43	NM	123	NM	144	NM	152	NM	153	NM	197	NM	179	NM	13	NM	8	NM	76	NM	149	NM	6	NM	
8-Jul-09	-144	NM	56	NM	-2	NM	27	NM	51	NM	56	NM	23	NM	26	NM	24	NM	47	NM	84	NM	112	NM	59	NM	65	
22-Jul-09	NM	18	NM	44	NM	93	NM	87	NM	90	NM	94	NM	89	NM	53	NM	22	NM	23	NM	27	NM	-18	NM	40	NM	
4-Aug-09	-3	NM	-159	NM	-36	NM	11	NM	32	NM	-35	NM	54	NM	-44	NM	34	NM	17	NM	-4	NM	31	NM	23	NM	74	
19-Aug-09	NM	12	NM	-2	NM	41	NM	52	NM	46	NM	56	NM	75	NM	40	NM	28	NM	62	NM	43	NM	-22	NM	-4	NM	
9-Sep-09	-150	NM	48	NM	-41	NM	-5	NM	32	NM	37	NM	3	NM	17	NM	4	NM	3	NM	30	NM	49	NM	43	NM	72	
23-Sep-09	NM	30	NM	9	NM	78	NM	106	NM	113	NM	133	NM	120	NM	45	NM	39	NM	1	NM	43	NM	43	NM	-10	NM	
7-Oct-09	-168	NM	3	NM	-39	NM	-15	NM	8	NM	23	NM	-12	NM	22	NM	-13	NM	-3	NM	34	NM	30	NM	38	NM	60	
21-Oct-09	NM	44	NM	-25	NM	28	NM	76	NM	68	NM	111	NM	107	NM	7	NM	44	NM	27	NM	-12	NM	-31	NM	-10	NM	
18-Nov-09	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	NM	-27	32	47	61	-16	38											
2-Dec-09	-12	NM	39	NM	4	NM	58	NM	76	NM	-9	NM	55	NM	43	NM	75	NM	77	NM	66	NM	94	NM	84	NM	72	
16-Dec-09	NM	110	NM	108	NM	-4	NM	18	NM	28	NM	32	NM	45	NM	-16	NM	-10	NM	32	NM	-41	NM	-4	NM	43	NM	
30-Dec-09	-158	NM	12	NM	7	NM	45	NM	11	NM	42	NM	-26	NM	4	NM	16	NM	27	NM	53	NM	17	NM	31	NM	54	
14-Jan-10	NM	52	NM	96	NM	121	NM	43	NM	57	NM	111	NM	39	NM	167	NM	114	NM	127	NM	-28	NM	34	NM	84	NM	
28-Jan-10	-144	NM	72	NM	56	NM	-6	NM	30	NM	39	NM	-6	NM	-39	NM	4	NM	38	NM	30	NM	20	NM	41	NM	56	
4-Mar-10	-148	NM	54	NM	87	NM	-42	NM	12	NM	35	NM	-13	NM	-35	NM	19	NM	3	NM	25	NM	-11	NM	28	NM	44	
25-Mar-10	NM	-35	NM	-6	NM	23	NM	29	NM	-41	NM	-10	NM	10	NM	152	NM	125	NM	105	NM	-66	NM	-4	NM	27	NM	
15-Apr-10	-138	NM	42	NM	77	NM	76	NM	-52	NM	-6	NM	-23	NM	-43	NM	26	NM	28	NM	-49	NM	-8	NM	15	NM	25	
29-Apr-10	NM	-13	NM	3	NM	17	NM	-16	NM	-3	NM	5	NM	-25	NM	-34	NM	6	NM	-3	NM	-70	NM	-14	NM	8	NM	
20-May-10	-158	NM	17	NM	52	NM	68	NM	-31	NM	6	NM	-59	NM	-14	NM	-20	NM	-20	NM	-59	NM	-65	NM	-15	NM	31	
3-Jun-10	NM	-6	NM	-7	NM	1	NM	20	NM	9	NM	-24	NM	230	NM	-51	NM	-22	NM	-17	NM	-63	NM	-36	NM	-27	NM	
17-Jun-10	-221	NM	39	NM	58	NM	65	NM	-36	NM	-4	NM	-32	NM	-45	NM	-6	NM	-4	NM	-70	NM	-34	NM	-18	NM	7	
13-Jul-10	NM	23	NM	82	NM	43	NM	430	NM	1	NM	63	NM	18	NM	-69	NM	27	NM	-44	NM							
29-Jul-10	NM	-57	NM	-18	NM	-13	NM	7	NM	12	NM	15	NM	-24	NM	8	NM	-7	NM	8	NM	3	NM	41	NM	42		
12-Aug-10	NM	12	NM	11	NM	8	NM	27	NM	35	NM	38	NM	35	NM	89	NM	82	NM	69	NM	52	NM	56	NM	48	NM	
26-Aug-10	-65	NM	-19	NM	13	NM	19	NM	6	NM	23	NM	-10	NM	-21	NM	16	NM	16	NM	18	NM	7	NM	43	NM	33	
9-Sep-10	NM	7	NM	-10	NM	18	NM	2	NM	23	NM	35	NM	40	NM	8	NM	15	NM	23	NM	37	NM	45	NM	33	NM	
23-Sep-10	-92	NM	-29	NM	-14	NM	-5	NM	-3	NM	2	NM	1	NM	2	NM	22	NM	13	NM	18	NM	13	NM	32	NM	30	
7-Oct-10	NM	-24	NM	-15	NM	11	NM	-10	NM	4	NM	-3	NM	5	NM	15	NM											



## ATTACHMENT A

### **Groundwater Laboratory Analytical Data**

**ANALYTICAL RESULTS**

Prepared by:

Eurofins Lancaster Laboratories Environmental  
2425 New Holland Pike  
Lancaster, PA 17601

Prepared for:

SUN: Aquaterra Tech.  
PO Box 744  
West Chester PA 19381

September 20, 2013

Project: SUN: Philadelphia Refinery 26th Street

Submittal Date: 09/12/2013  
Group Number: 1418435  
PO Number: PHILADELPHIA  
State of Sample Origin: PA

Client Sample Description

S-50_091113 Grab Groundwater
S-210_091113 Grab Groundwater
S-226_091113 Grab Groundwater
S-230_091113 Grab Groundwater
S-231_091113 Grab Groundwater
S-232_091113 Grab Groundwater

Lancaster Labs (LL) #

7195275
7195276
7195277
7195278
7195279
7195280

The specific methodologies used in obtaining the enclosed analytical results are indicated on the Laboratory Sample Analysis Record.

ELECTRONIC	Langan	Attn: Dennis Webster
COPY TO		
ELECTRONIC	SUN: Aquaterra Tech.	Attn: Tiffani Doerr
COPY TO		
ELECTRONIC	Langan	Attn: Kristen Ward
COPY TO		
ELECTRONIC	Aquaterra Tech	Attn: Loretta Belfiglio
COPY TO		



Lancaster Laboratories  
Environmental

## ***Analysis Report***

2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • [www.LancasterLabs.com](http://www.LancasterLabs.com)

Respectfully Submitted,



Amek Carter  
Specialist

(717) 556-7252



2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • www.LancasterLabs.com

Sample Description: S-50\_091113 Grab Groundwater  
Philadelphia Refinery 26th Street  
COC: 238731 S-50

LL Sample # WW 7195275  
LL Group # 1418435  
Account # 10132

Project Name: SUN: Philadelphia Refinery 26th Street

Collected: 09/11/2013 13:30 by LM

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 09/12/2013 14:22

Reported: 09/20/2013 13:47

--S50

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
	<b>GC/MS Volatiles</b>	<b>SW-846 8260B</b>	<b>ug/l</b>	<b>ug/l</b>	<b>ug/l</b>	
10943	Benzene	71-43-2	1,100	10	5	10
10943	Ethylbenzene	100-41-4	12	10	5	10
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 10	10	5	10
10943	Toluene	108-88-3	470	10	5	10
10943	Xylene (Total)	1330-20-7	35	10	5	10

#### General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/14

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

#### Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 03:19	Kevin A Sposito	10
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F132624AA	09/20/2013 03:19	Kevin A Sposito	10

\*=This limit was used in the evaluation of the final result



2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • www.LancasterLabs.com

**Sample Description:** S-210\_091113 Grab Groundwater  
Philadelphia Refinery 26th Street  
COC: 238731 S-210

LL Sample # WW 7195276  
LL Group # 1418435  
Account # 10132

**Project Name:** SUN: Philadelphia Refinery 26th Street

Collected: 09/11/2013 13:00 by LM

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 09/12/2013 14:22

Reported: 09/20/2013 13:47

-S210

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
	<b>GC/MS Volatiles</b>	<b>SW-846 8260B</b>	<b>ug/l</b>	<b>ug/l</b>	<b>ug/l</b>	
10943	Benzene	71-43-2	39,000	500	250	500
10943	Ethylbenzene	100-41-4	820	50	25	50
10943	Methyl Tertiary Butyl Ether	1634-04-4	72	50	25	50
10943	Toluene	108-88-3	420	50	25	50
10943	Xylene (Total)	1330-20-7	360	50	25	50

#### General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/14

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

#### Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 03:41	Kevin A Sposito	50
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 04:03	Kevin A Sposito	500
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F132624AA	09/20/2013 03:41	Kevin A Sposito	50
01163	GC/MS VOA Water Prep	SW-846 5030B	2	F132624AA	09/20/2013 04:03	Kevin A Sposito	500

\*=This limit was used in the evaluation of the final result



2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • www.LancasterLabs.com

**Sample Description:** S-226\_091113 Grab Groundwater  
Philadelphia Refinery 26th Street  
COC: 238731 S-226

LL Sample # WW 7195277  
LL Group # 1418435  
Account # 10132

**Project Name:** SUN: Philadelphia Refinery 26th Street

Collected: 09/11/2013 12:30 by LM

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 09/12/2013 14:22

Reported: 09/20/2013 13:47

-S226

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
	<b>GC/MS Volatiles</b>	<b>SW-846 8260B</b>	<b>ug/l</b>	<b>ug/l</b>	<b>ug/l</b>	
10943	Benzene	71-43-2	17,000	200	100	200
10943	Ethylbenzene	100-41-4	110	20	10	20
10943	Methyl Tertiary Butyl Ether	1634-04-4	81	20	10	20
10943	Toluene	108-88-3	7,400	200	100	200
10943	Xylene (Total)	1330-20-7	460	20	10	20

#### General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/14

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

#### Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 04:25	Kevin A Sposito	20
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 04:47	Kevin A Sposito	200
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F132624AA	09/20/2013 04:25	Kevin A Sposito	20
01163	GC/MS VOA Water Prep	SW-846 5030B	2	F132624AA	09/20/2013 04:47	Kevin A Sposito	200

\*=This limit was used in the evaluation of the final result



2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • www.LancasterLabs.com

**Sample Description:** S-230\_091113 Grab Groundwater  
Philadelphia Refinery 26th Street  
COC: 238731 S-230

LL Sample # WW 7195278  
LL Group # 1418435  
Account # 10132

**Project Name:** SUN: Philadelphia Refinery 26th Street

Collected: 09/11/2013 10:00 by LM

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 09/12/2013 14:22

Reported: 09/20/2013 13:47

-S230

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
	<b>GC/MS Volatiles</b>	<b>SW-846 8260B</b>	<b>ug/l</b>	<b>ug/l</b>	<b>ug/l</b>	
10943	Benzene	71-43-2	4,600	50	25	50
10943	Ethylbenzene	100-41-4	32	5	3	5
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 5	5	3	5
10943	Toluene	108-88-3	82	5	3	5
10943	Xylene (Total)	1330-20-7	27	5	3	5

#### General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/14

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

#### Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 05:09	Kevin A Sposito	5
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 05:31	Kevin A Sposito	50
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F132624AA	09/20/2013 05:09	Kevin A Sposito	5
01163	GC/MS VOA Water Prep	SW-846 5030B	2	F132624AA	09/20/2013 05:31	Kevin A Sposito	50

\*=This limit was used in the evaluation of the final result



2425 New Holland Pike, Lancaster, PA 17601 • 717-656-2300 • Fax: 717-656-2681 • www.LancasterLabs.com

Sample Description: S-231\_091113 Grab Groundwater  
Philadelphia Refinery 26th Street  
COC: 238731 S-231

LL Sample # WW 7195279  
LL Group # 1418435  
Account # 10132

Project Name: SUN: Philadelphia Refinery 26th Street

Collected: 09/11/2013 11:30 by LM

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 09/12/2013 14:22

Reported: 09/20/2013 13:47

-S231

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
	<b>GC/MS Volatiles</b>	<b>SW-846 8260B</b>	<b>ug/l</b>	<b>ug/l</b>	<b>ug/l</b>	
10943	Benzene	71-43-2	540	10	5	10
10943	Ethylbenzene	100-41-4	41	10	5	10
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 10	10	5	10
10943	Toluene	108-88-3	57	10	5	10
10943	Xylene (Total)	1330-20-7	550	10	5	10

#### General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/14

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

#### Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 05:52	Kevin A Sposito	10
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F132624AA	09/20/2013 05:52	Kevin A Sposito	10

\*=This limit was used in the evaluation of the final result



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**Sample Description:** S-232\_091113 Grab Groundwater  
Philadelphia Refinery 26th Street  
COC: 238731 S-232

LL Sample # WW 7195280  
LL Group # 1418435  
Account # 10132

**Project Name:** SUN: Philadelphia Refinery 26th Street

Collected: 09/11/2013 11:00 by LM

SUN: Aquaterra Tech.

PO Box 744

West Chester PA 19381

Submitted: 09/12/2013 14:22

Reported: 09/20/2013 13:47

-S232

CAT No.	Analysis Name	CAS Number	As Received Result	As Received Limit of Quantitation*	As Received Method Detection Limit	Dilution Factor
	<b>GC/MS Volatiles</b>	<b>SW-846 8260B</b>	ug/l	ug/l	ug/l	
10943	Benzene	71-43-2	44	1	0.5	1
10943	Ethylbenzene	100-41-4	8	1	0.5	1
10943	Methyl Tertiary Butyl Ether	1634-04-4	< 1	1	0.5	1
10943	Toluene	108-88-3	30	1	0.5	1
10943	Xylene (Total)	1330-20-7	11	1	0.5	1

#### General Sample Comments

PA DEP Lab Certification ID 36-00037, Expiration Date: 1/31/14

All QC is compliant unless otherwise noted. Please refer to the Quality Control Summary for overall QC performance data and associated samples.

#### Laboratory Sample Analysis Record

CAT No.	Analysis Name	Method	Trial#	Batch#	Analysis Date and Time	Analyst	Dilution Factor
10943	UST BTEX, MTBE in Water	SW-846 8260B	1	F132624AA	09/20/2013 06:14	Kevin A Sposito	1
01163	GC/MS VOA Water Prep	SW-846 5030B	1	F132624AA	09/20/2013 06:14	Kevin A Sposito	1

\*=This limit was used in the evaluation of the final result

## Quality Control Summary

Client Name: SUN: Aquaterra Tech.  
Reported: 09/20/13 at 01:47 PM

Group Number: 1418435

Matrix QC may not be reported if insufficient sample or site-specific QC samples were not submitted. In these situations, to demonstrate precision and accuracy at a batch level, a LCS/LCSD was performed, unless otherwise specified in the method.

All Inorganic Initial Calibration and Continuing Calibration Blanks met acceptable method criteria unless otherwise noted on the Analysis Report.

### Laboratory Compliance Quality Control

<u>Analysis Name</u>	<u>Blank Result</u>	<u>Blank LOQ**</u>	<u>Blank MDL</u>	<u>Report Units</u>	LCS %REC	LCSD %REC	<u>LCS/LCSD Limits</u>	<u>RPD</u>	<u>RPD Max</u>
Batch number: F132624AA				Sample number(s): 7195275-7195280					
Benzene	< 1	1.	0.5	ug/l	90	90	78-120	0	30
Ethylbenzene	< 1	1.	0.5	ug/l	88	89	79-120	1	30
Methyl Tertiary Butyl Ether	< 1	1.	0.5	ug/l	96	95	75-120	0	30
Toluene	< 1	1.	0.5	ug/l	92	92	80-120	0	30
Xylene (Total)	< 1	1.	0.5	ug/l	90	91	80-120	1	30

### Surrogate Quality Control

Surrogate recoveries which are outside of the QC window are confirmed unless attributed to dilution or otherwise noted on the Analysis Report.

Analysis Name: UST BTEX, MTBE in Water

Batch number: F132624AA

	Dibromofluoromethane	1,2-Dichloroethane-d4	Toluene-d8	4-Bromofluorobenzene
7195275	96	95	100	93
7195276	97	96	100	93
7195277	96	95	100	94
7195278	96	95	101	94
7195279	97	96	99	95
7195280	97	97	100	94
Blank	99	100	99	92
LCS	100	100	99	95
LCSD	100	99	100	96
Limits:	80-116	77-113	80-113	78-113

\*- Outside of specification

\*\*-This limit was used in the evaluation of the final result for the blank

(1) The result for one or both determinations was less than five times the LOQ.

(2) The unspiked result was more than four times the spike added.

# Analysis Request/ Environmental Services Chain of Custody



For Lancaster Laboratories use only

Acct. # 10132 Group# 1418435 Sample # 7195275-80

**COC # 238731**

Please print. Instructions on reverse side correspond with circled numbers.

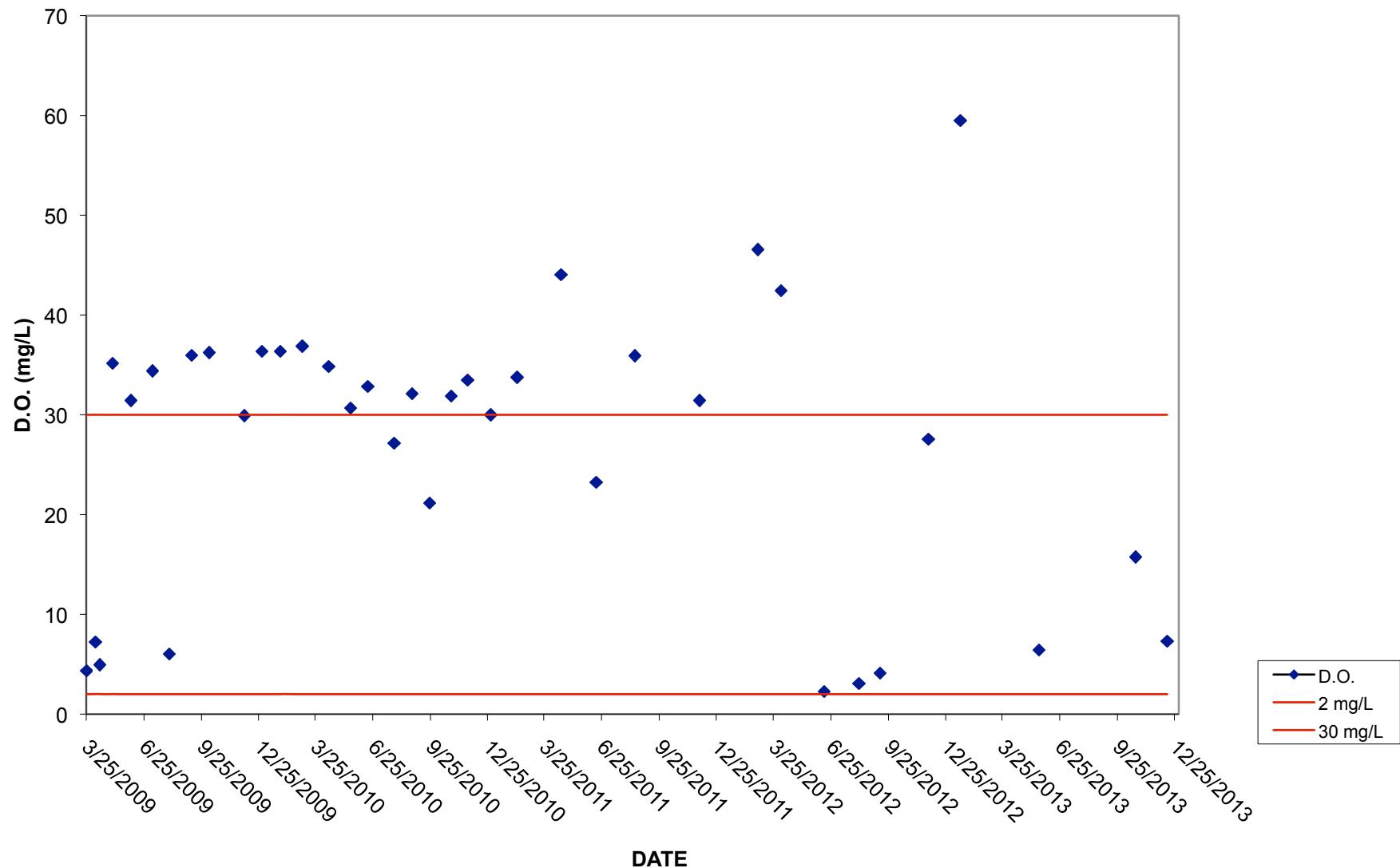
<b>1</b> Client: <u>AQUATELLA</u> Project Name/#: <u>SUN. Philly Ref-2655</u> Project Manager: <u>T. Doerr</u> Sampler: <u>Luke Molenycki</u> Name of state where samples were collected: <u>PA</u>			<b>2</b> <b>Sample Identification</b> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 30%;">Date Collected</th> <th style="width: 30%;">Time Collected</th> <th style="width: 10%;">Grab</th> <th style="width: 10%;">Composite</th> <th style="width: 10%;">Soil</th> <th style="width: 10%;">Water</th> <th style="width: 10%;">Other</th> <th style="width: 10%;">Total # of Containers</th> </tr> </thead> <tbody> <tr><td>9-11-13</td><td>1330</td><td>X</td><td></td><td>GW</td><td></td><td></td><td>3</td></tr> <tr><td>9-11-13</td><td>1300</td><td>X</td><td></td><td>GW</td><td></td><td></td><td>3</td></tr> <tr><td>9-11-13</td><td>1230</td><td>X</td><td></td><td>GW</td><td></td><td></td><td>3</td></tr> <tr><td>9-11-13</td><td>1000</td><td>X</td><td></td><td>GW</td><td></td><td></td><td>3</td></tr> <tr><td>9-11-13</td><td>1130</td><td>X</td><td></td><td>GW</td><td></td><td></td><td>3</td></tr> <tr><td>9-11-13</td><td>1100</td><td>X</td><td></td><td>GW</td><td></td><td></td><td>3</td></tr> </tbody> </table>			Date Collected	Time Collected	Grab	Composite	Soil	Water	Other	Total # of Containers	9-11-13	1330	X		GW			3	9-11-13	1300	X		GW			3	9-11-13	1230	X		GW			3	9-11-13	1000	X		GW			3	9-11-13	1130	X		GW			3	9-11-13	1100	X		GW			3	<b>3</b> <b>Matrix</b> <input checked="" type="checkbox"/> Soil <input type="checkbox"/> Water <input type="checkbox"/> Other <input type="checkbox"/> Potable <input type="checkbox"/> NPDES <input type="checkbox"/> Check if Applicable			<b>4</b> <b>5 Analyses Requested</b> <b>Preservation Codes</b> BTEX MTBE			<b>6</b> <b>For Lab Use Only</b> FSC: _____ SCR#: _____  <b>Preservation Codes</b> H=HCl      T=Thiosulfate N=NHO <sub>3</sub> B=NaOH S=H <sub>2</sub> SO <sub>4</sub> O=Other		
Date Collected	Time Collected	Grab	Composite	Soil	Water	Other	Total # of Containers																																																															
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9-11-13	1100	X		GW			3																																																															
															<b>7</b> Turnaround Time Requested (TAT) (please circle): <input checked="" type="radio"/> Normal <input type="radio"/> Rush (Rush TAT is subject to Lancaster Laboratories approval and surcharge.) Date results are needed: _____ Rush results requested by (please circle): <input type="radio"/> Phone <input type="radio"/> Fax <input type="radio"/> E-mail Phone #: _____ Fax #: _____ E-mail address: _____	<b>8</b> <b>Data Package Options</b> (please circle if required) Type I (validation/NJ Reg) <input type="checkbox"/> TX TRRP-13 <input type="checkbox"/> SDG Complete? Type II (Tier II) <input type="checkbox"/> MA MCP <input type="checkbox"/> CT RCP <input type="checkbox"/> Yes <input type="checkbox"/> No Type III (Reduced NJ) <input type="checkbox"/> Type IV (CLP SOW) <input type="checkbox"/> Type VI (Raw Data Only) <input type="checkbox"/> Site-specific QC (MS/MSD/Dup)? <input type="checkbox"/> Yes <input type="checkbox"/> No <small>(If yes, indicate QC sample and submit triplicate volume.)</small> Internal COC Required? <input type="checkbox"/> Yes / <input type="checkbox"/> No			<b>9</b> Relinquished by: <u>Wendy</u> Date <u>9-11-13</u> Time <u>1600</u> Received by: <u>AQUATELLA SAMPLE FRIDGE</u> Date <u>9-11-13</u> Time <u>1600</u> Relinquished by: <u>S. Bortz</u> Date <u>9-12-13</u> Time <u>1100</u> Received by: <u>Leanne</u> Date <u>9-12-13</u> Time <u>1100</u> Relinquished by: <u>S. Bortz</u> Date <u>9-12-13</u> Time <u>1400</u> Received by: _____ Date _____ Time _____ Relinquished by: <u>S. Bortz</u> Date <u>9-12-13</u> Time <u>1400</u> Received by: _____ Date _____ Time _____ Relinquished by: <u>S. Bortz</u> Date <u>9-12-13</u> Time <u>1400</u> Received by: _____ Date _____ Time _____ Relinquished by: <u>S. Bortz</u> Date <u>9-12-13</u> Time <u>1400</u> Received by: _____ Date _____ Time _____																																																			



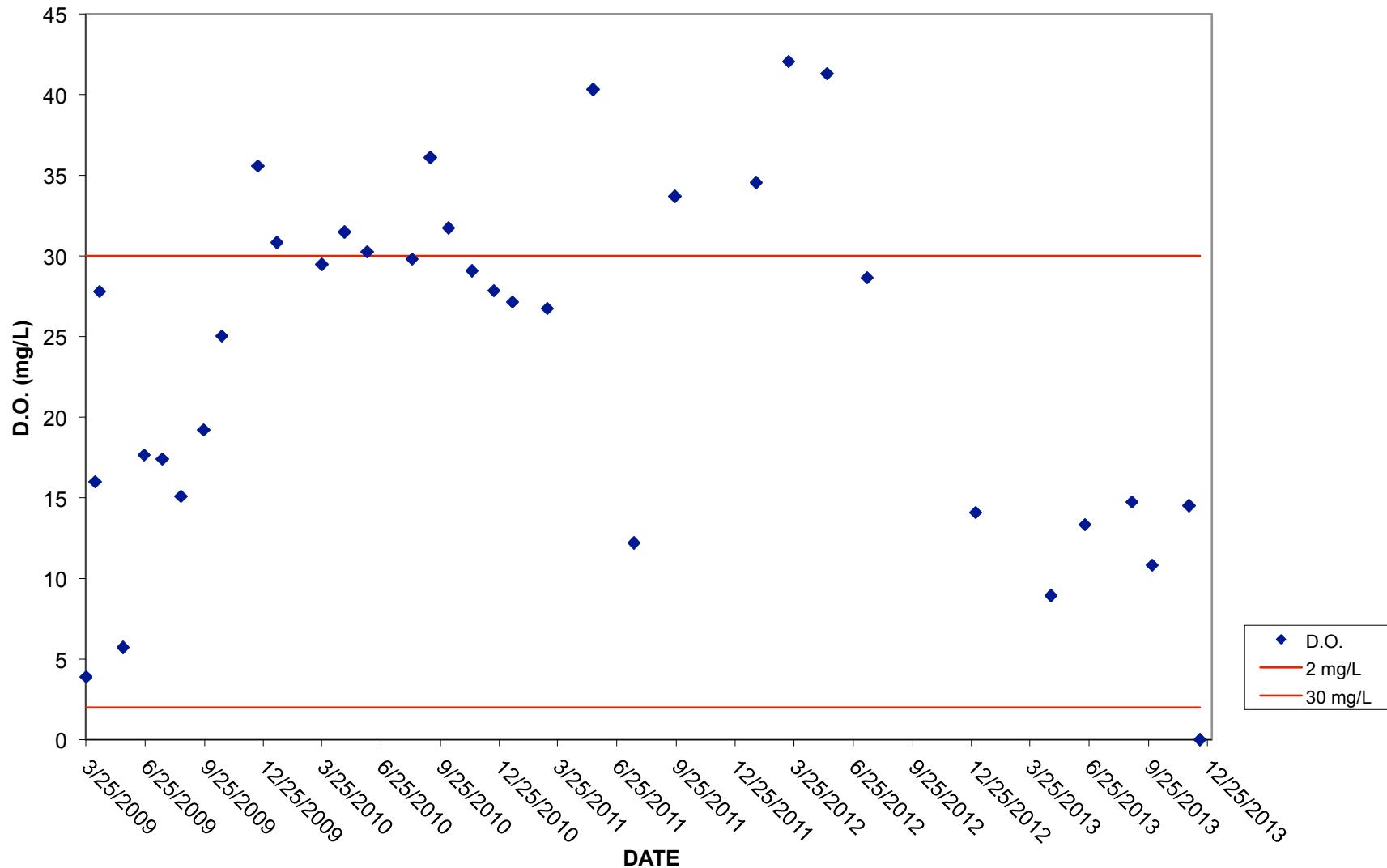
**ATTACHMENT B**

**DO Graphs for System Wells**

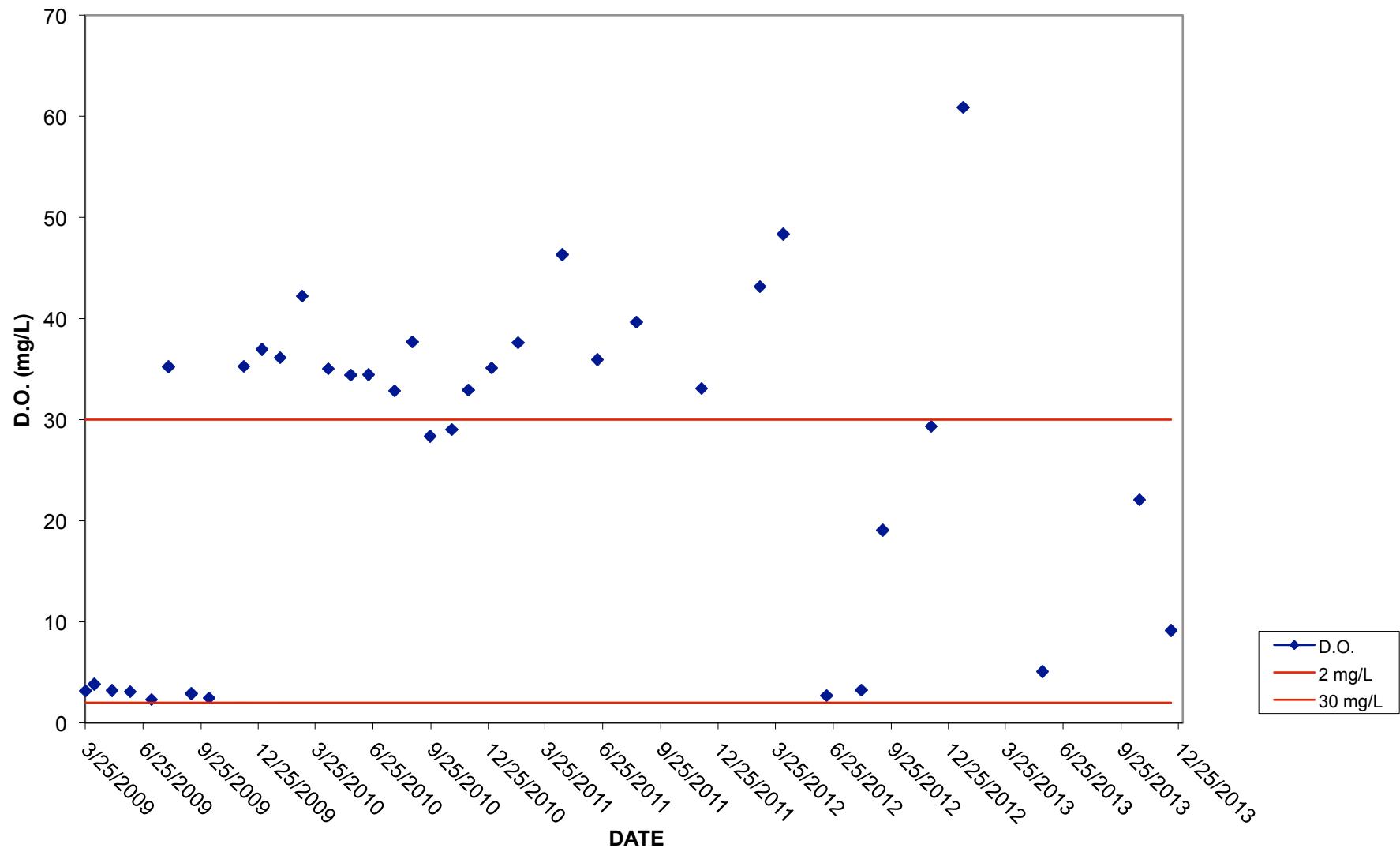
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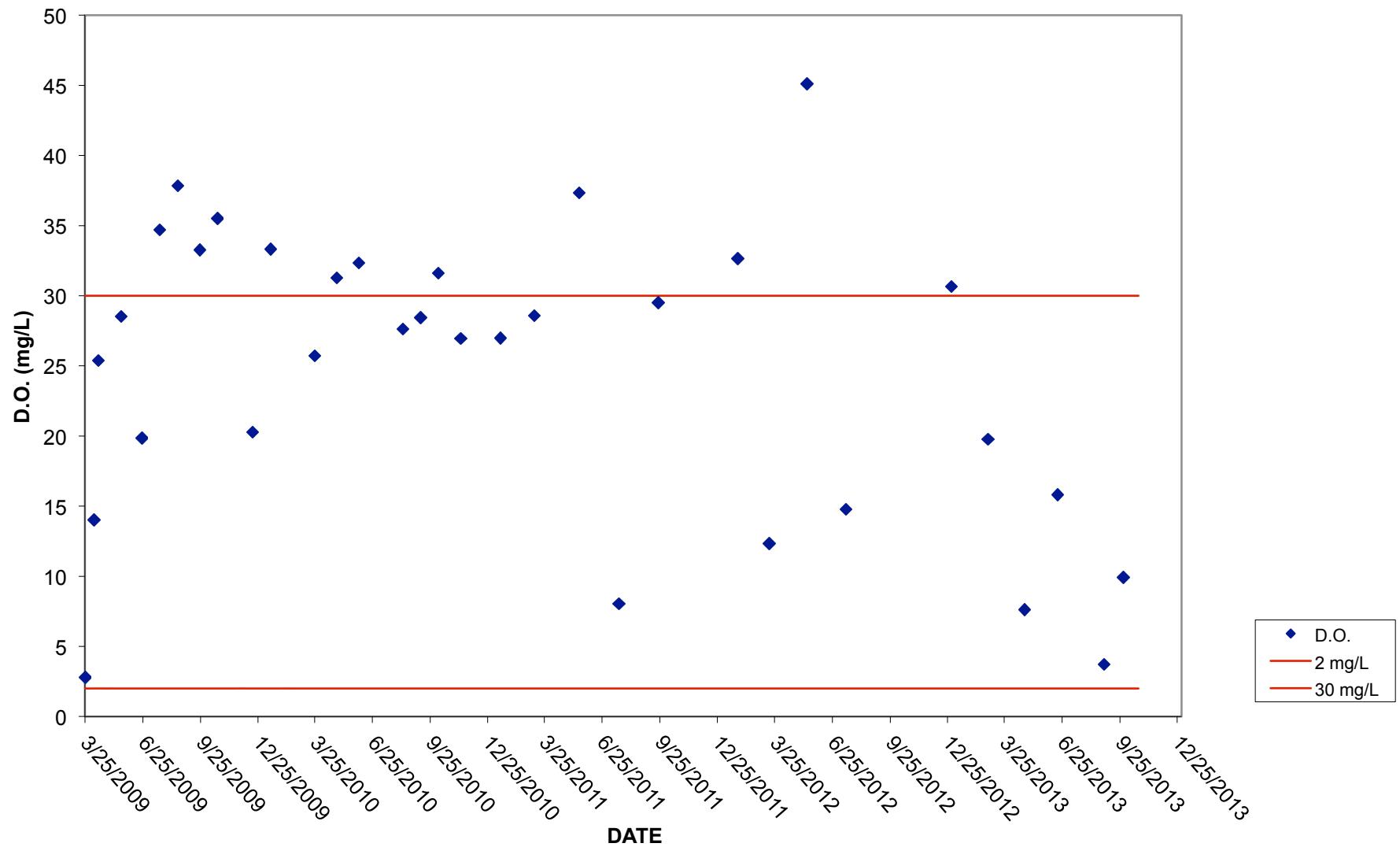
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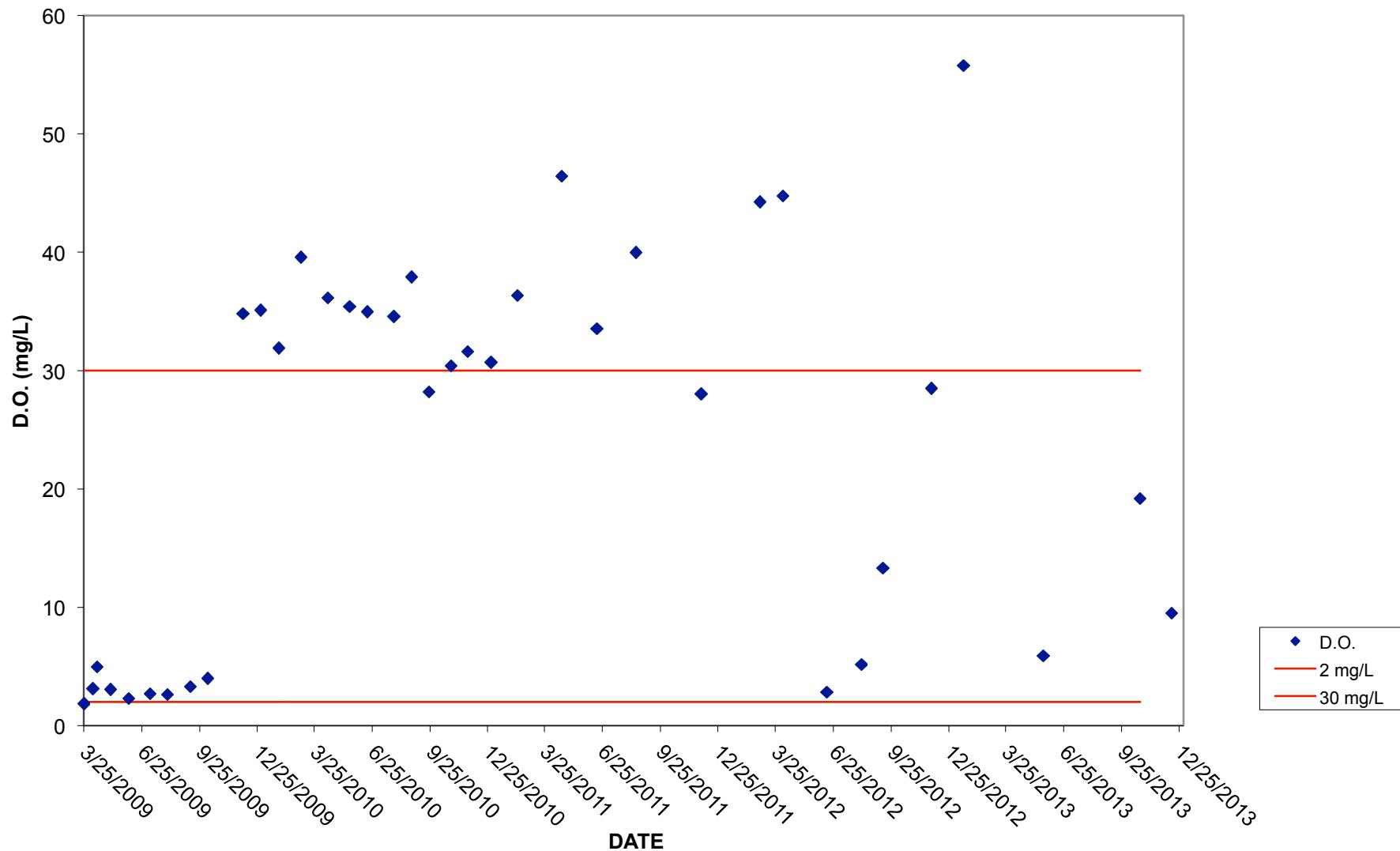
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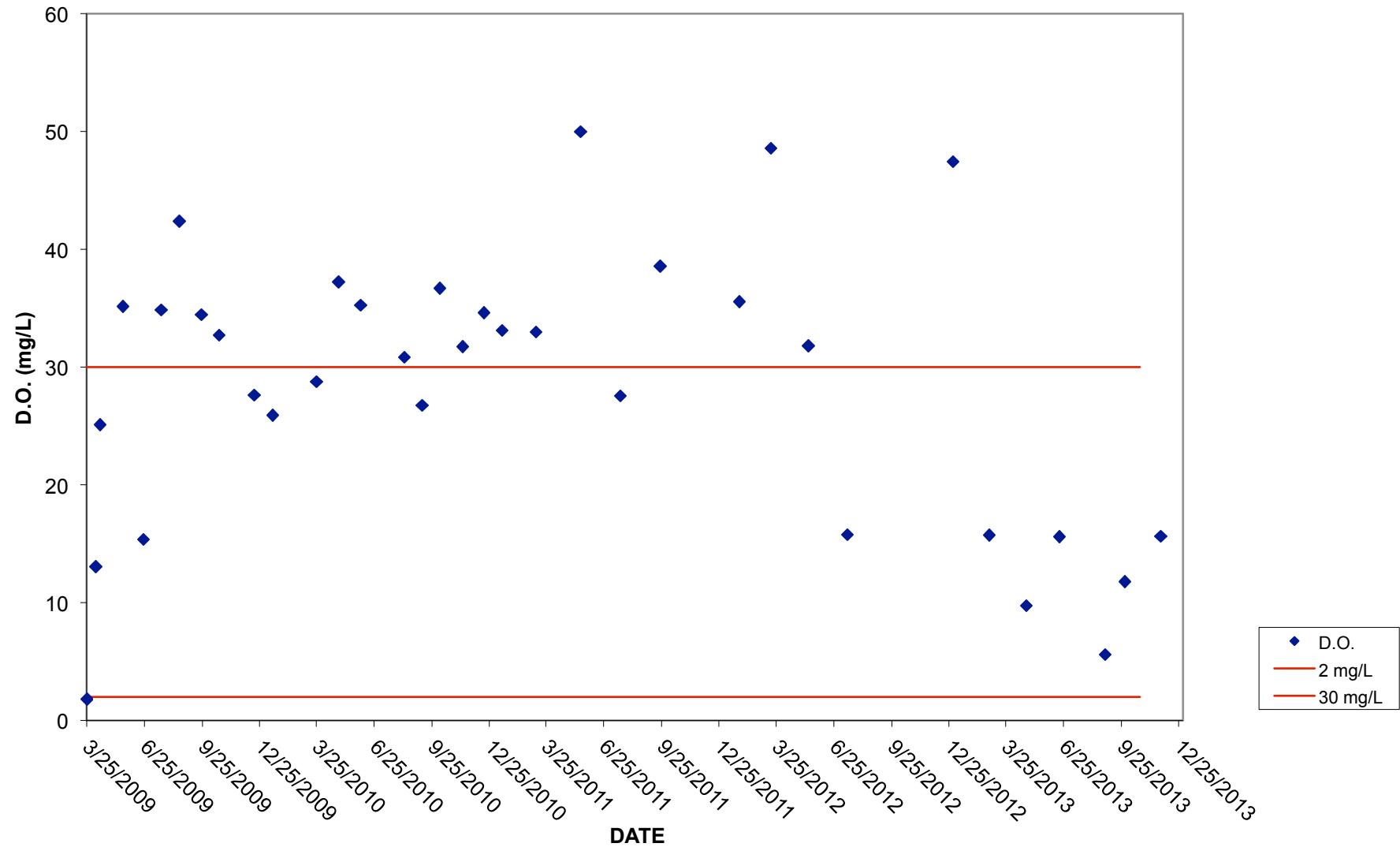
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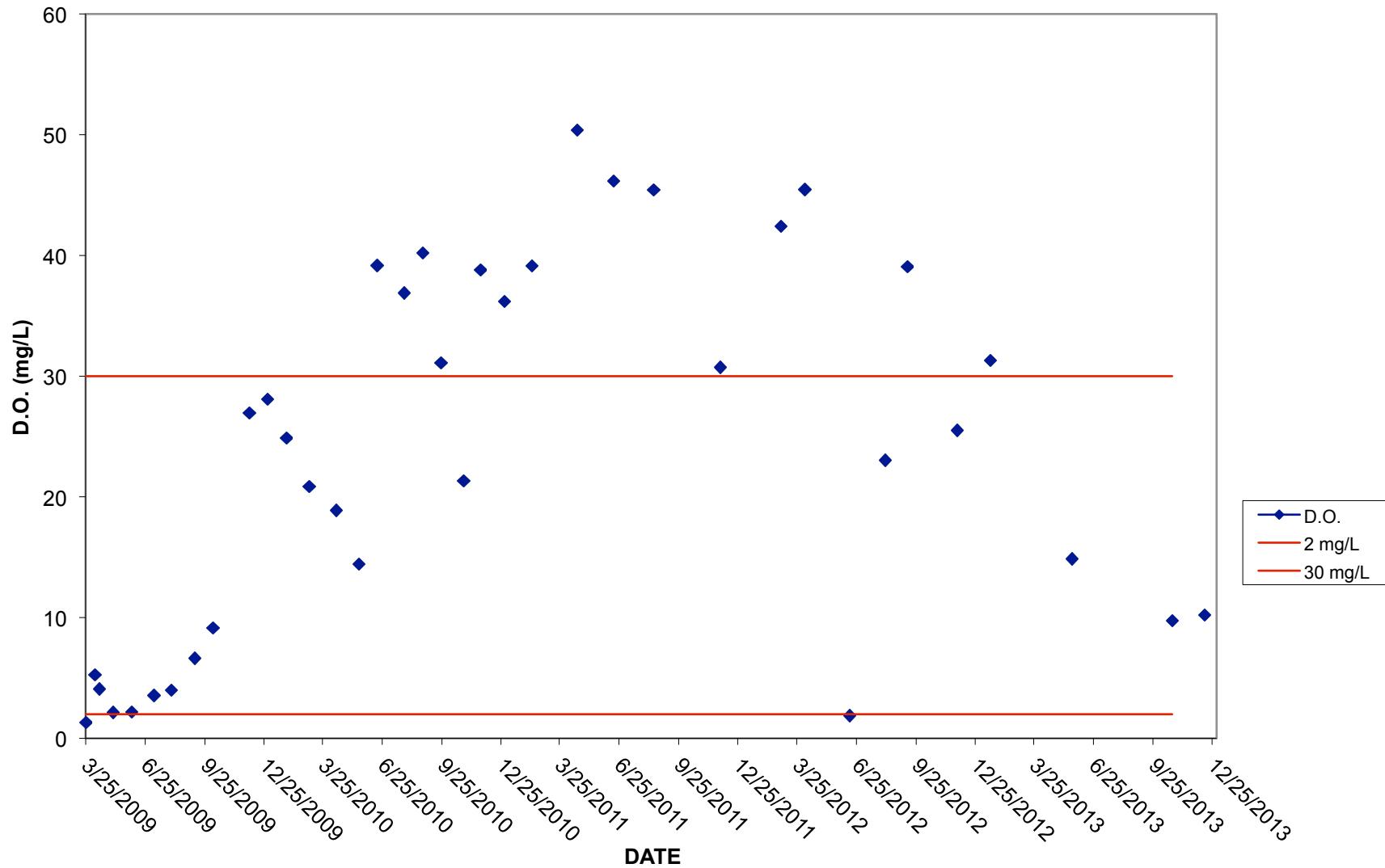
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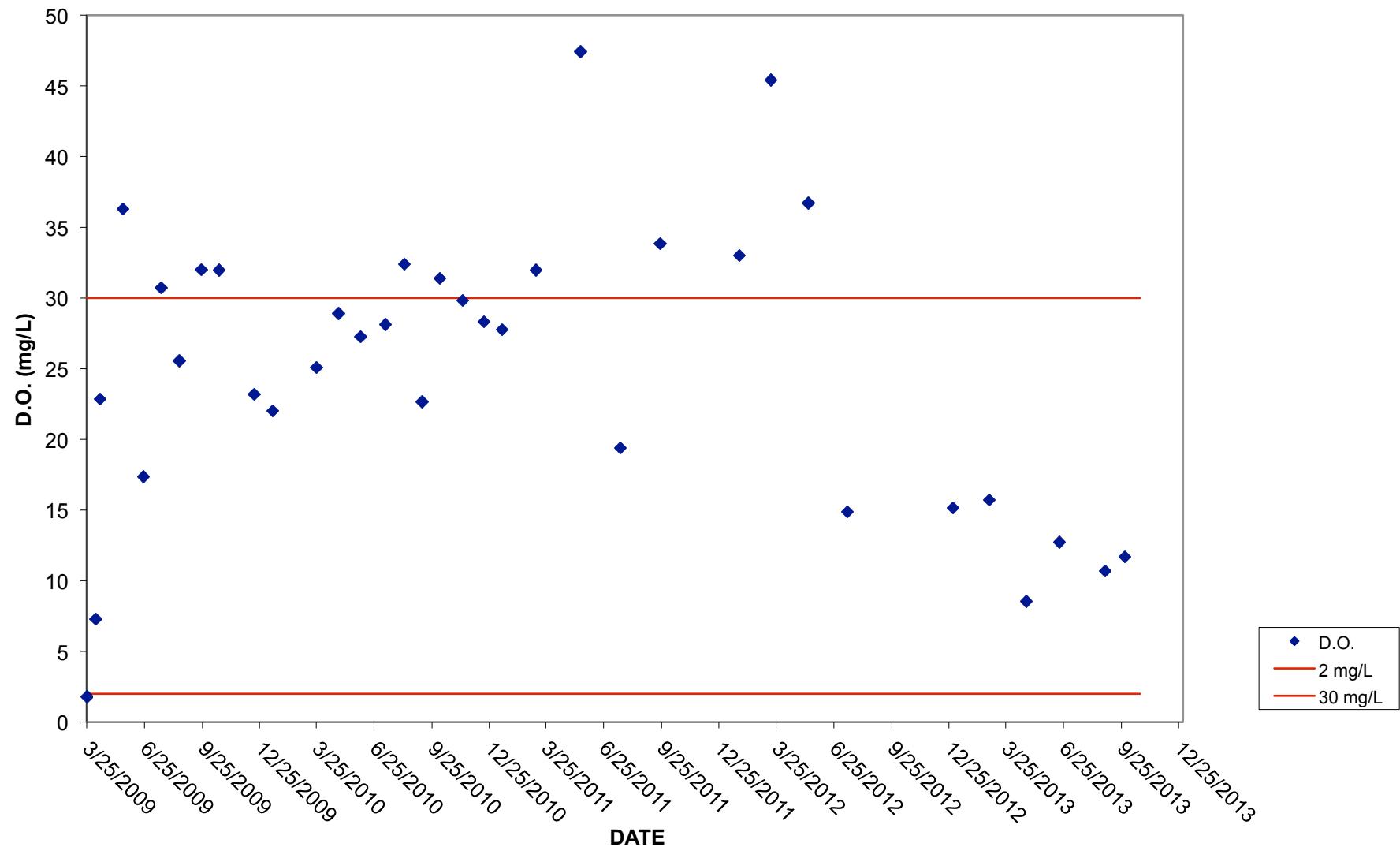
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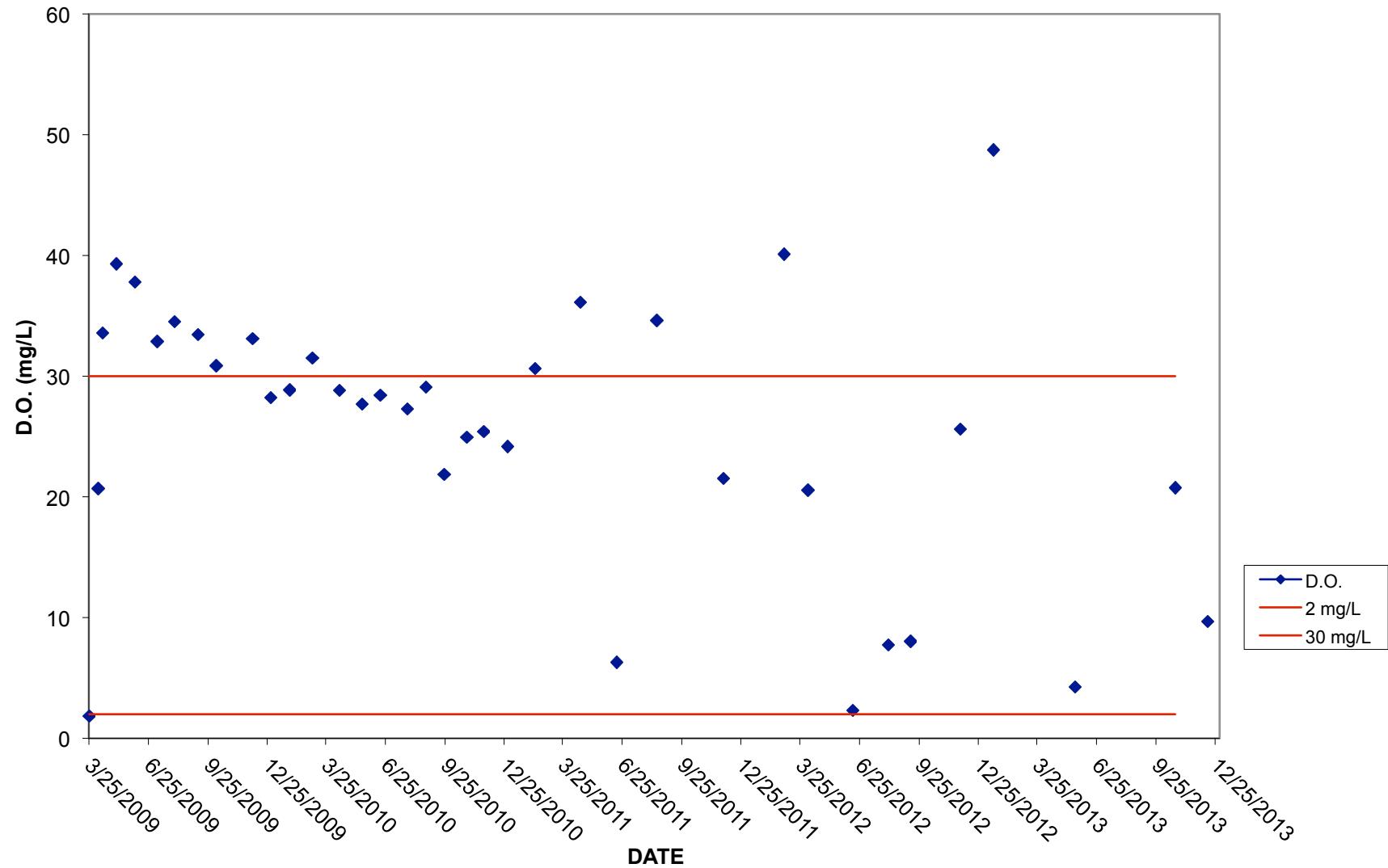
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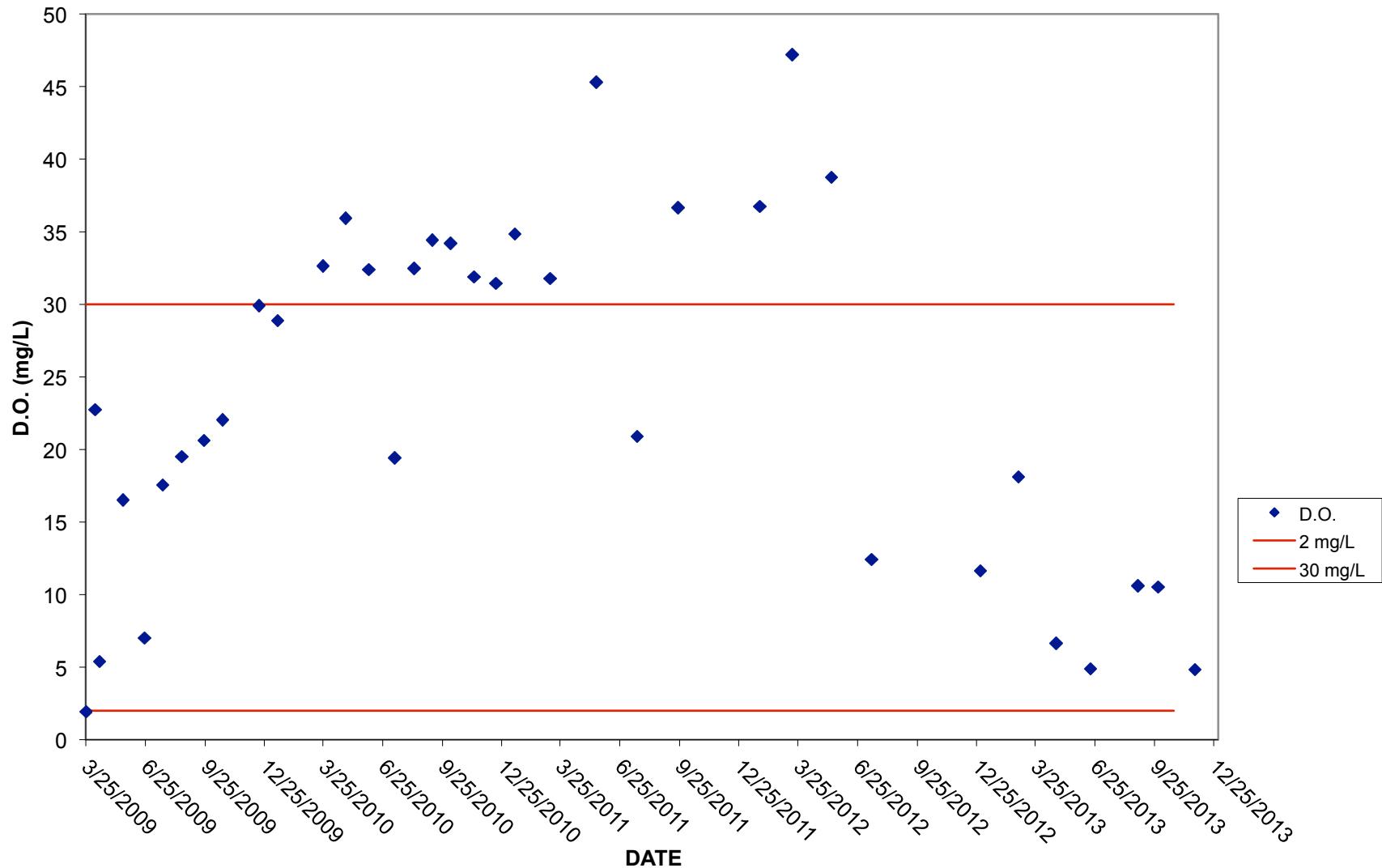
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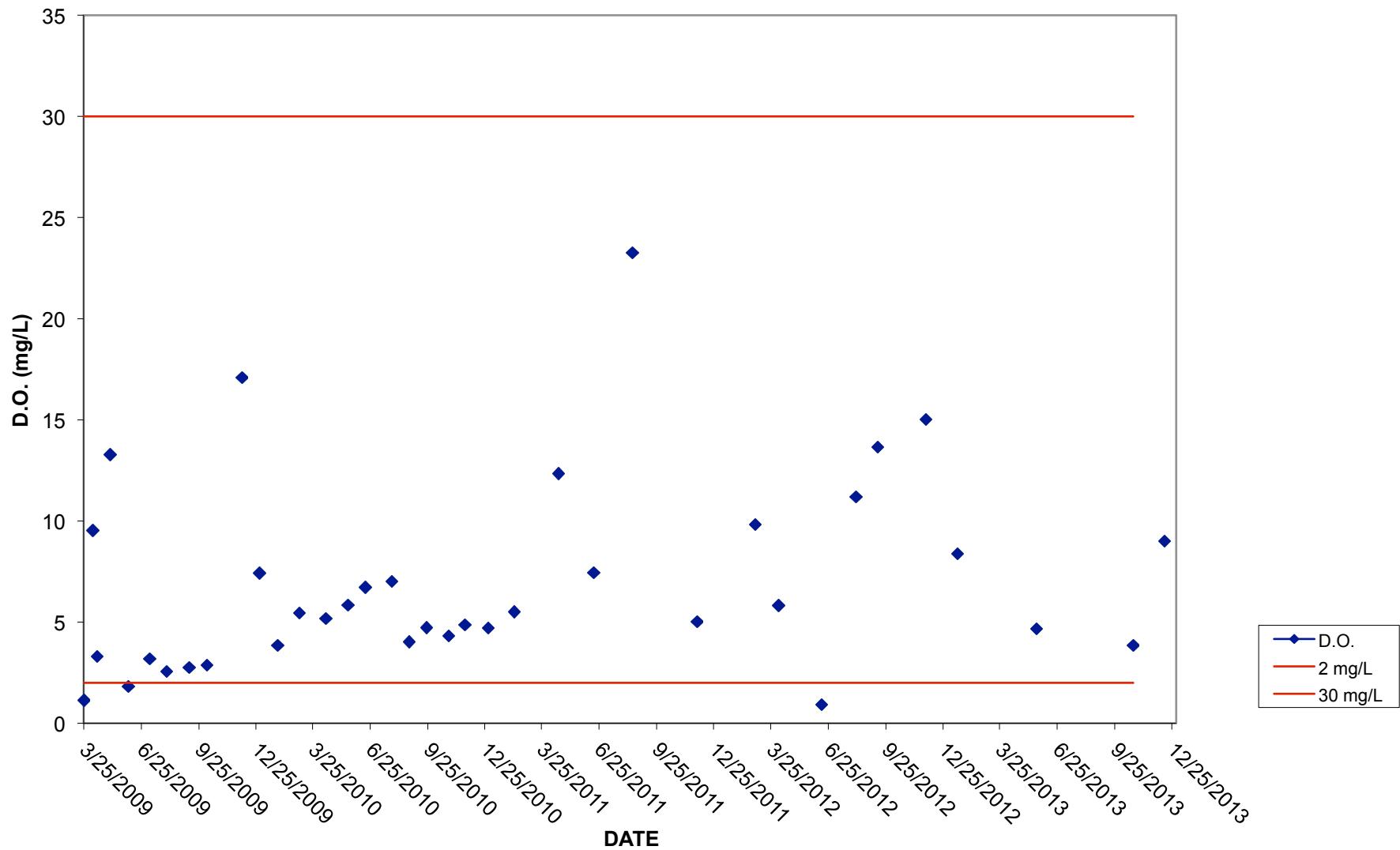
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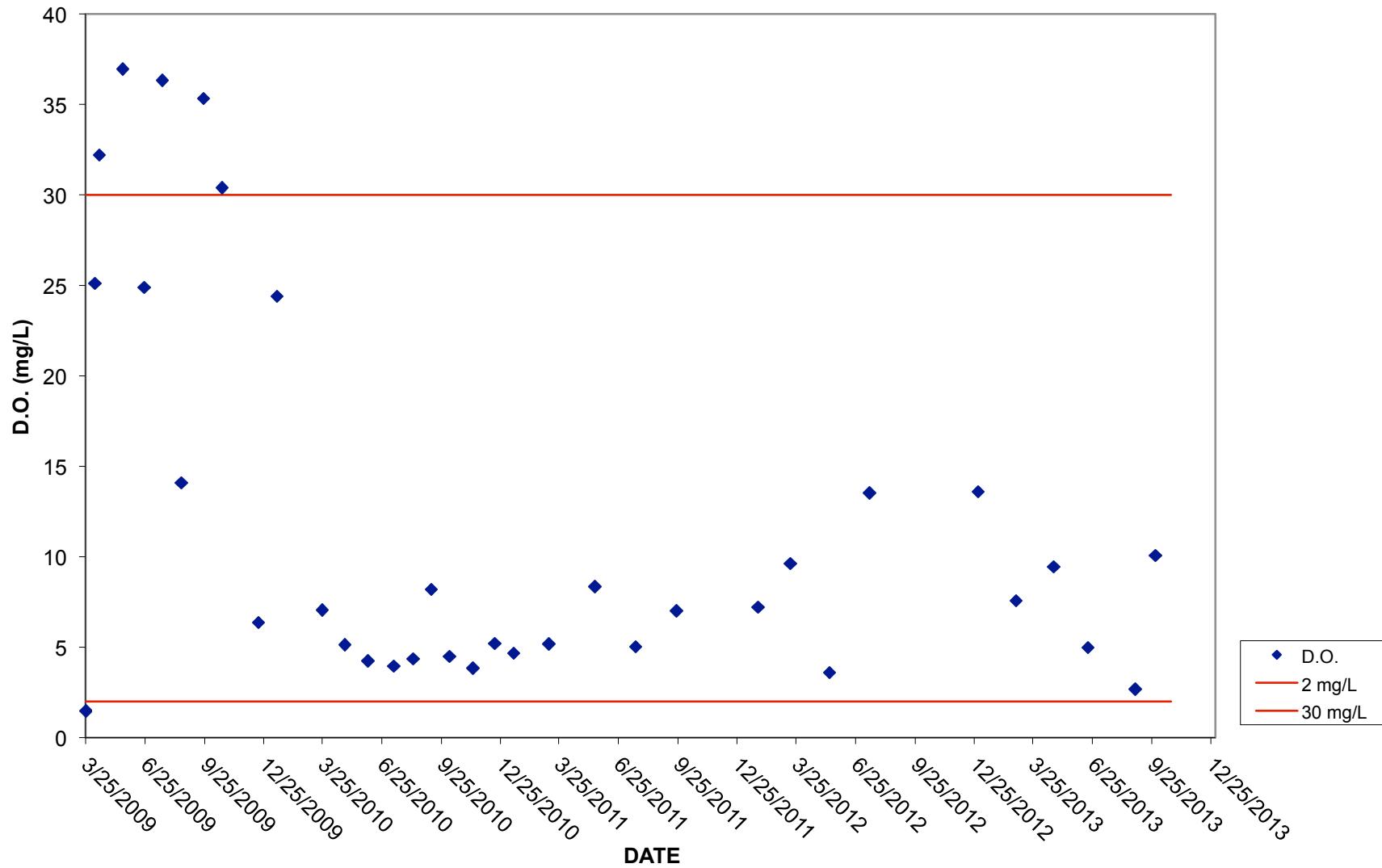
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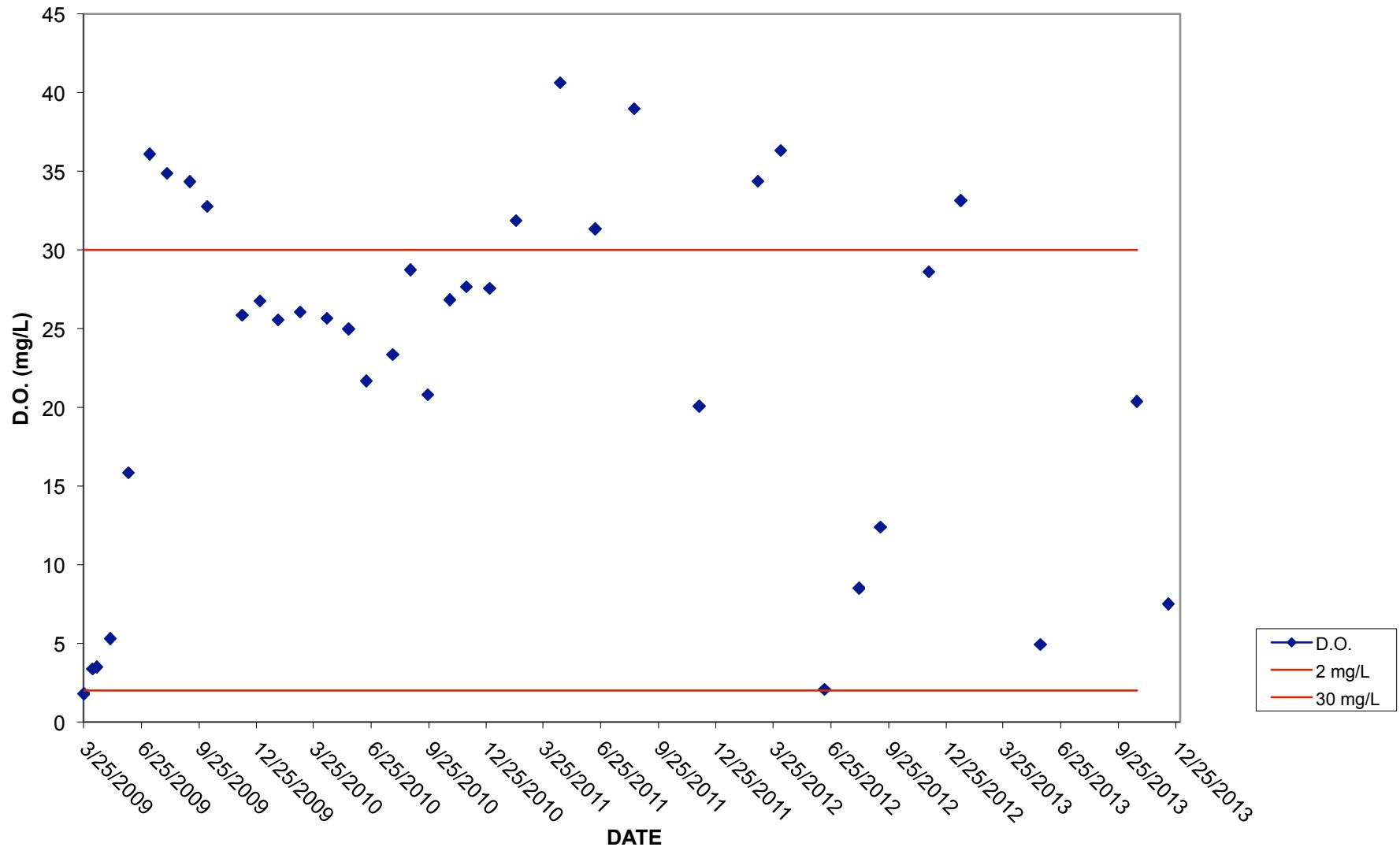
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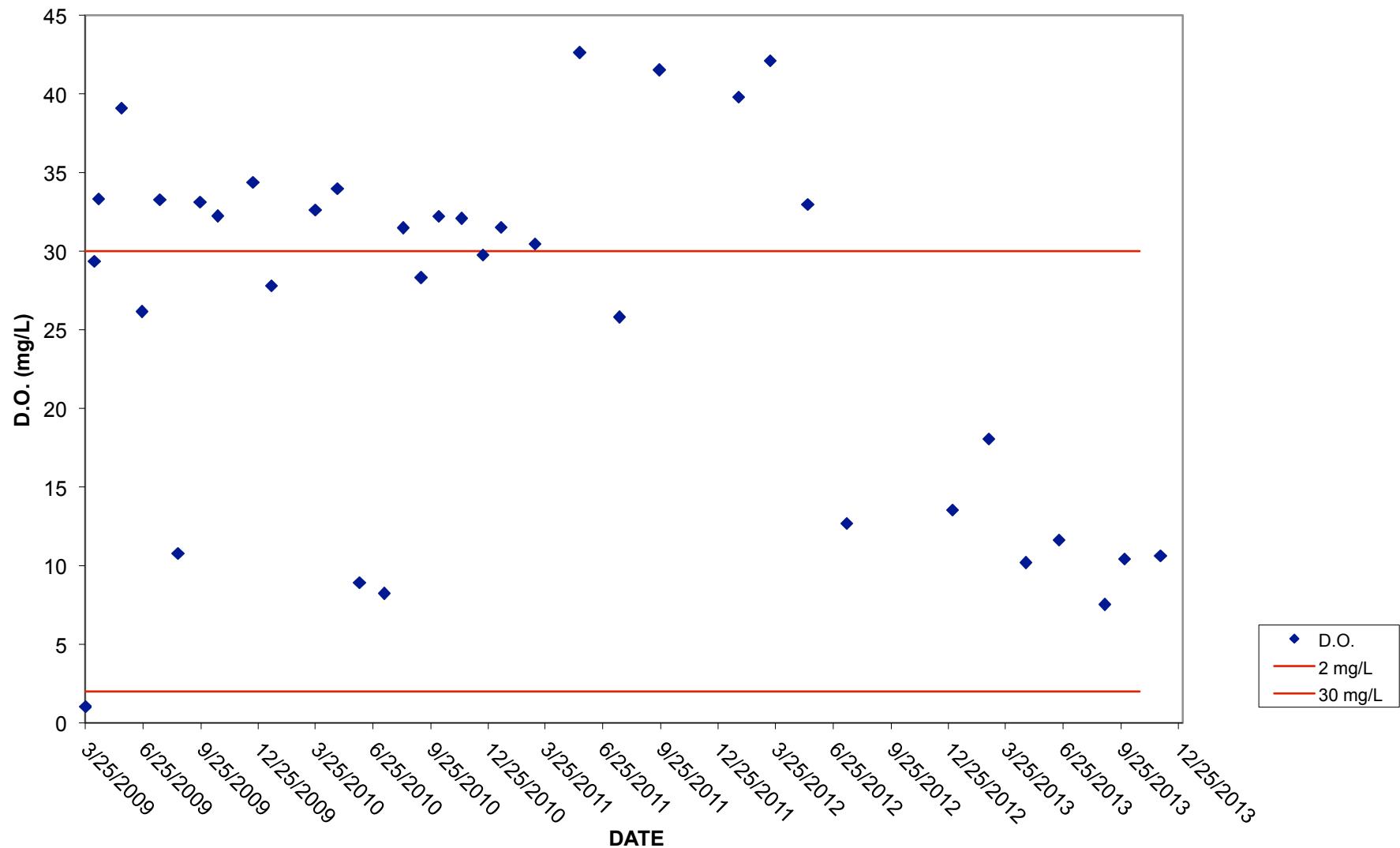
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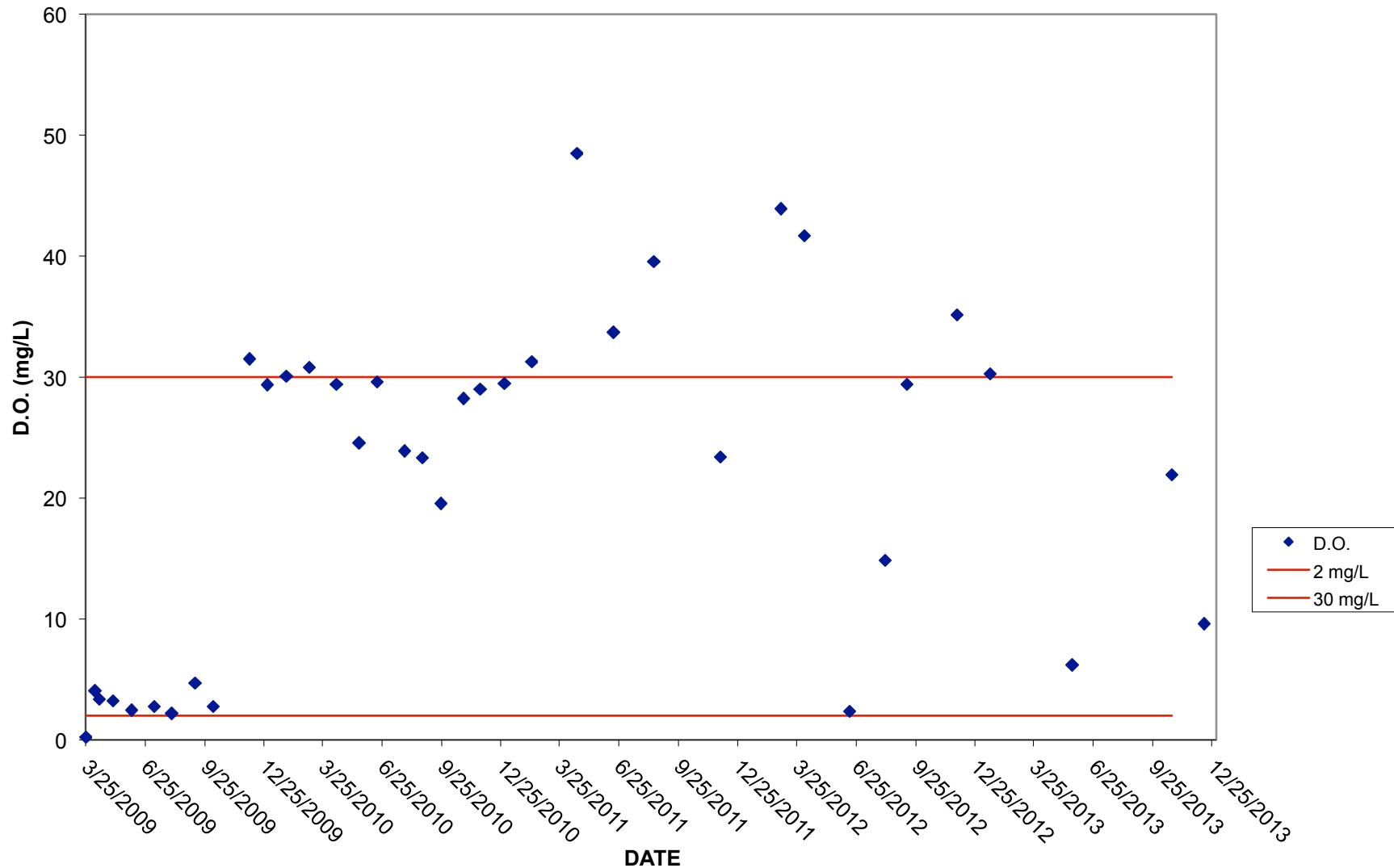
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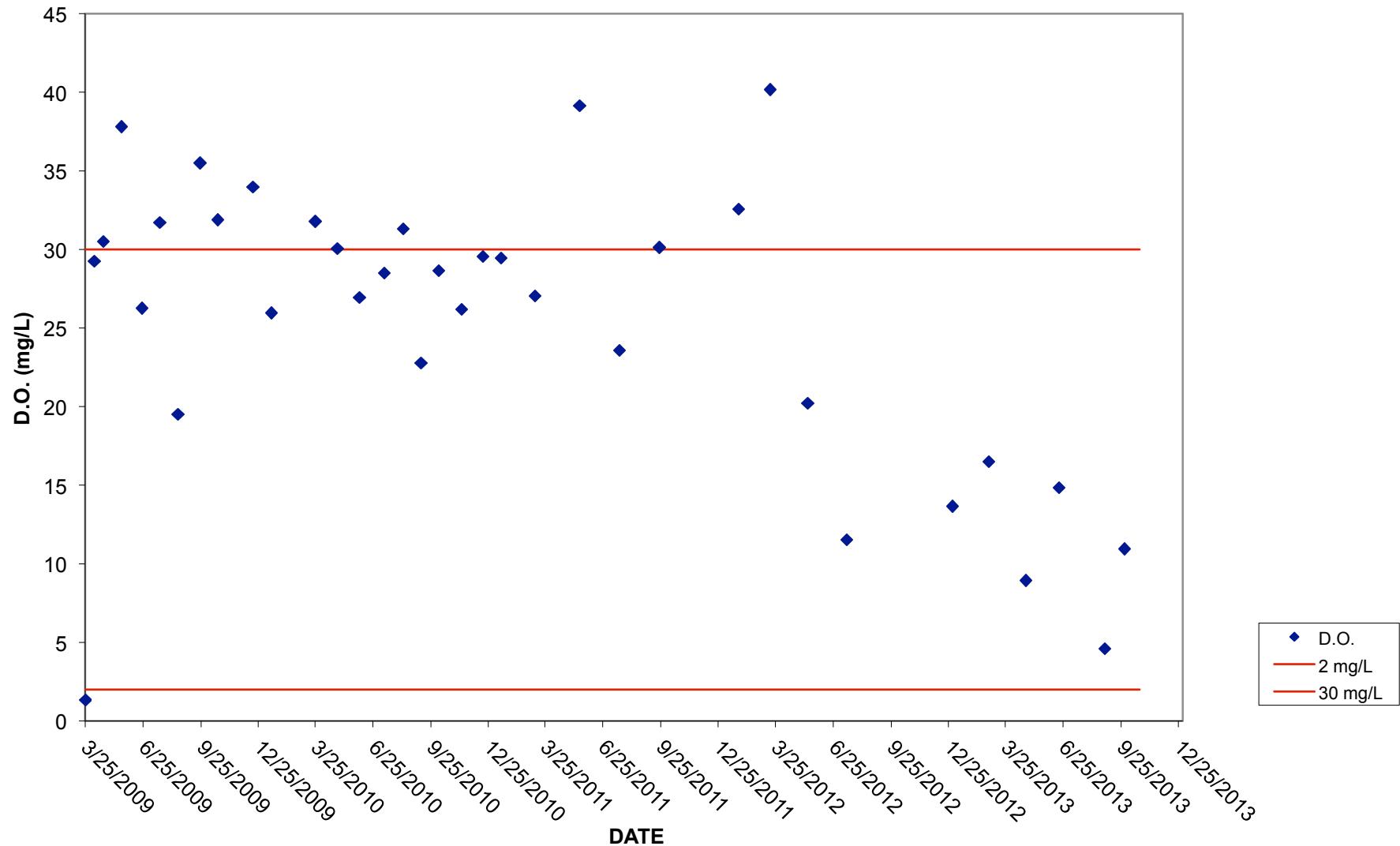
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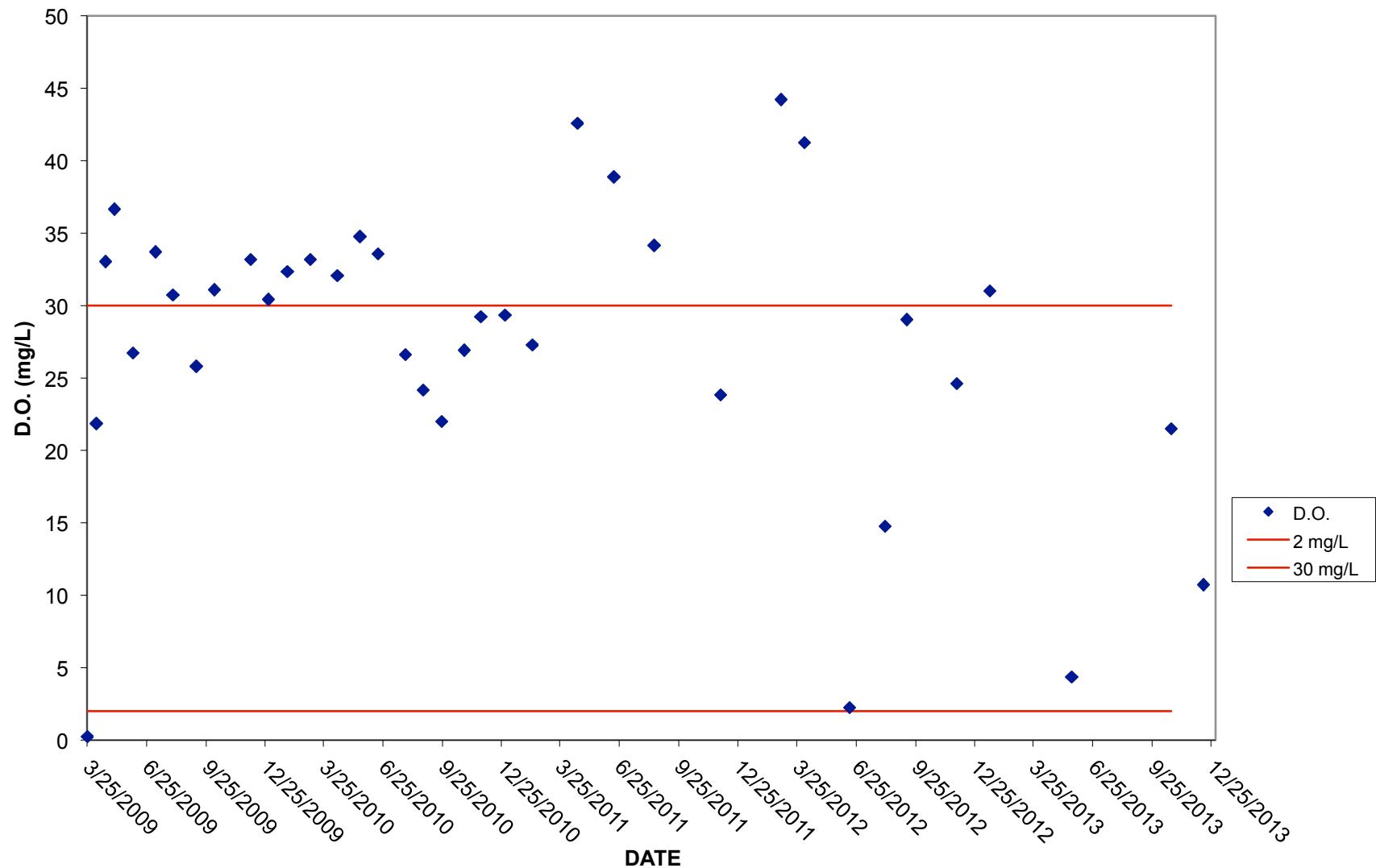
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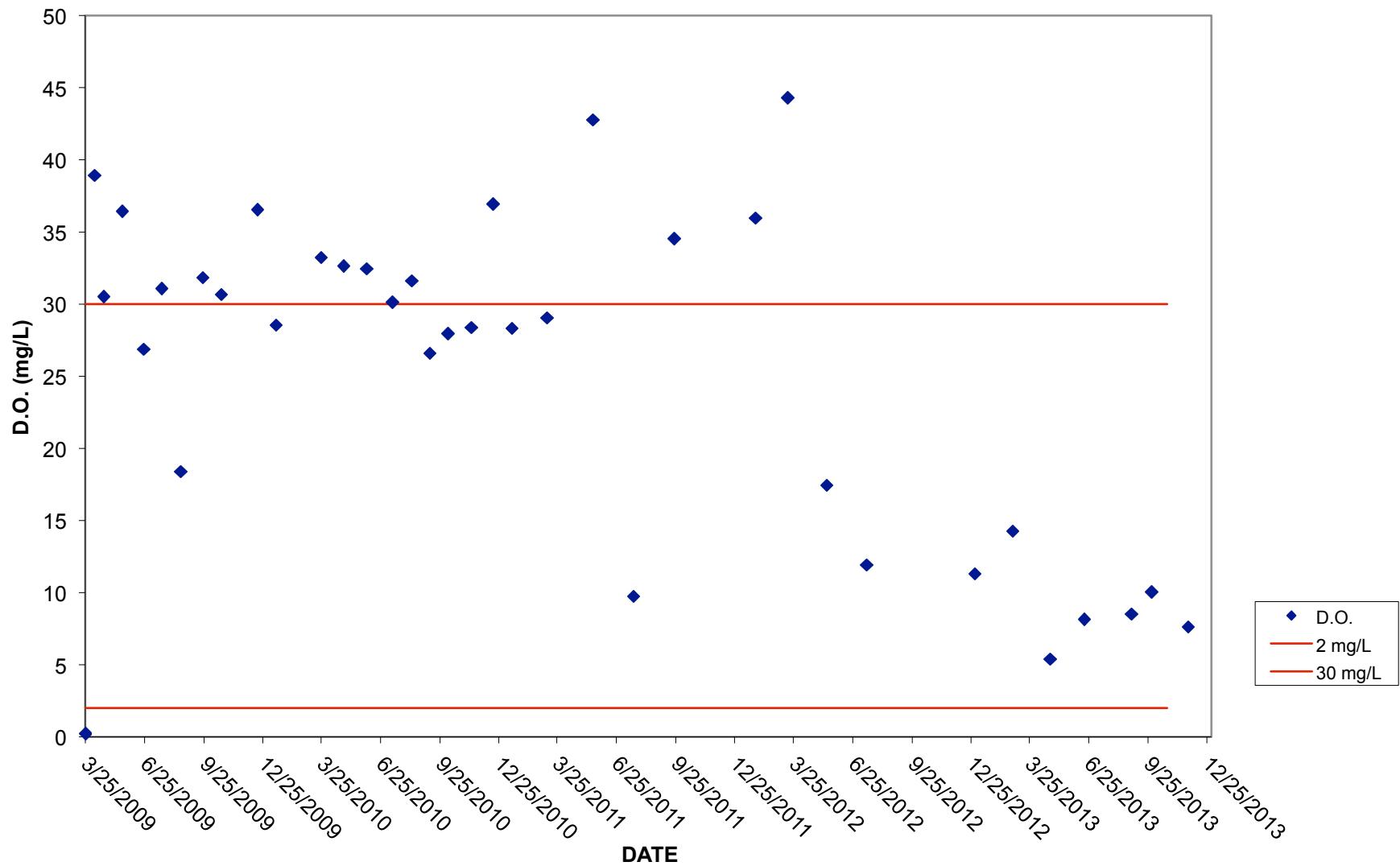
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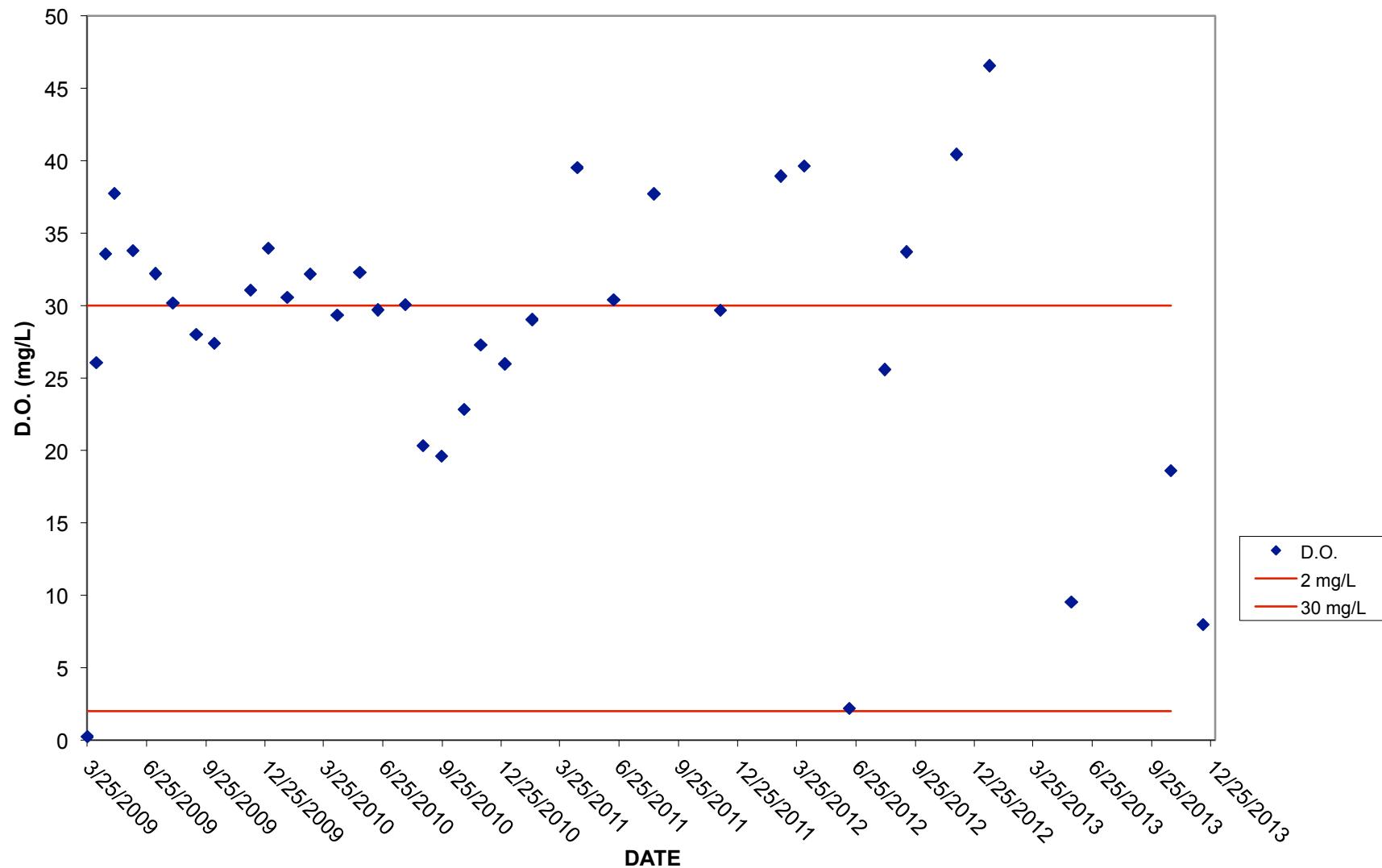
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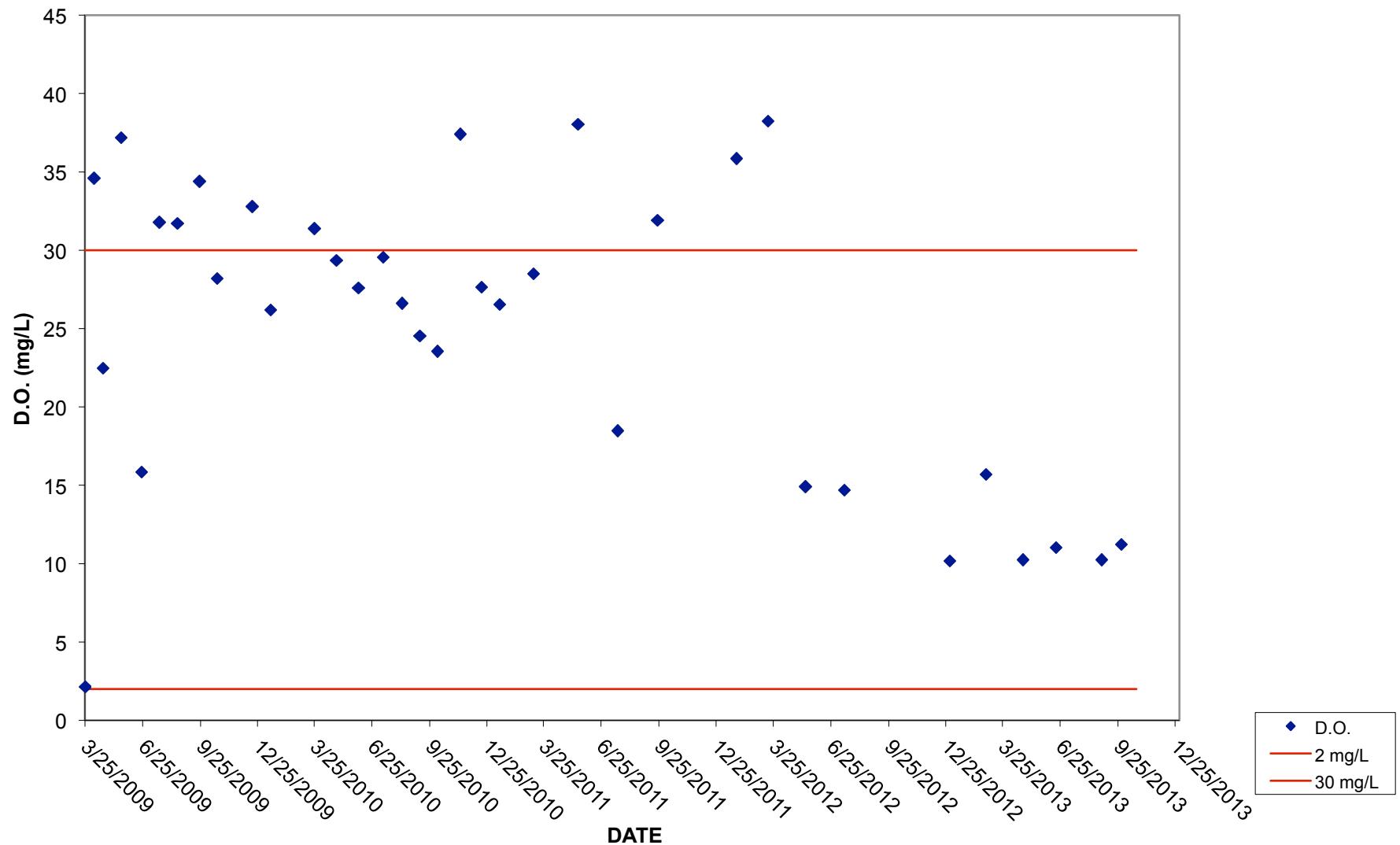
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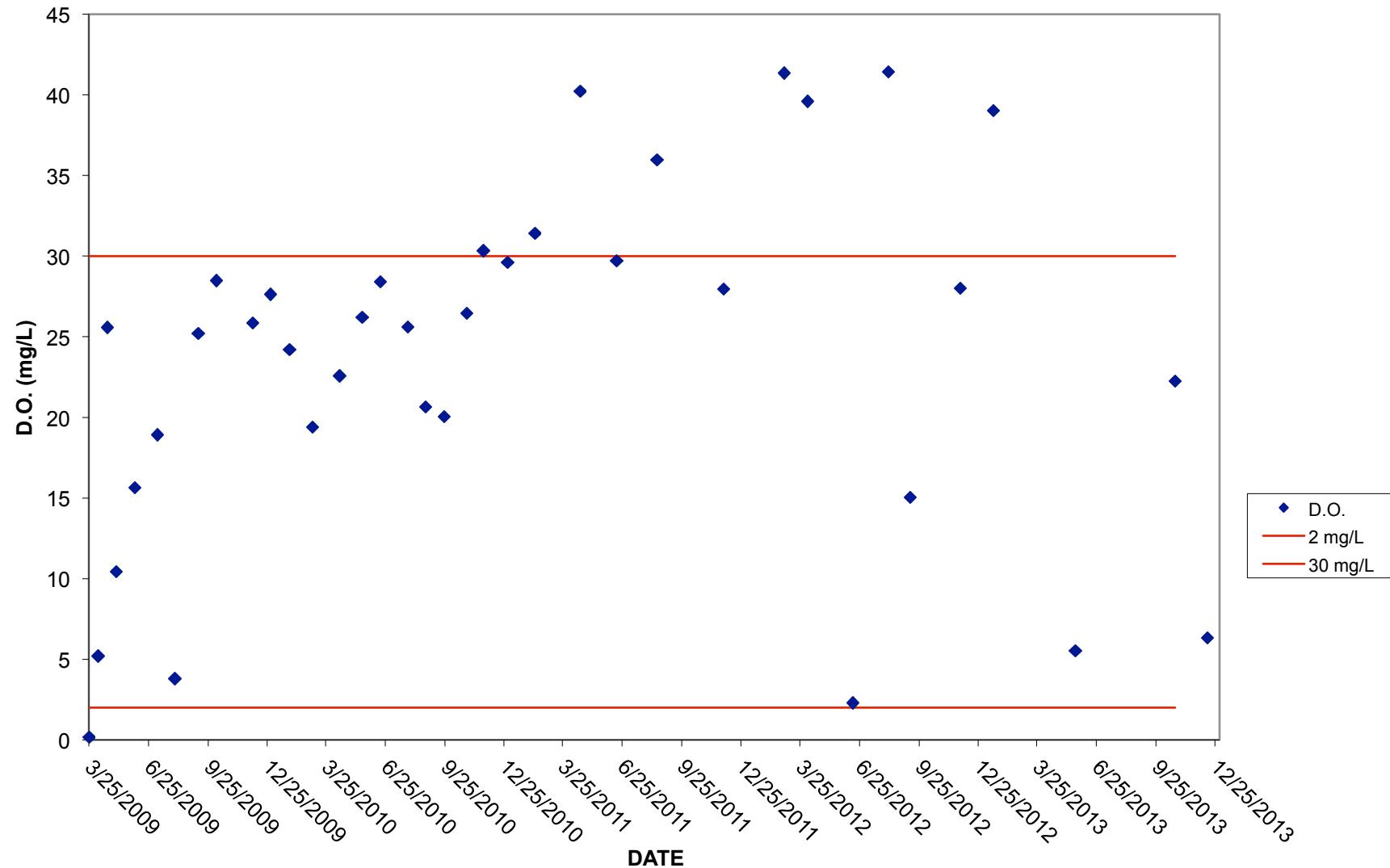
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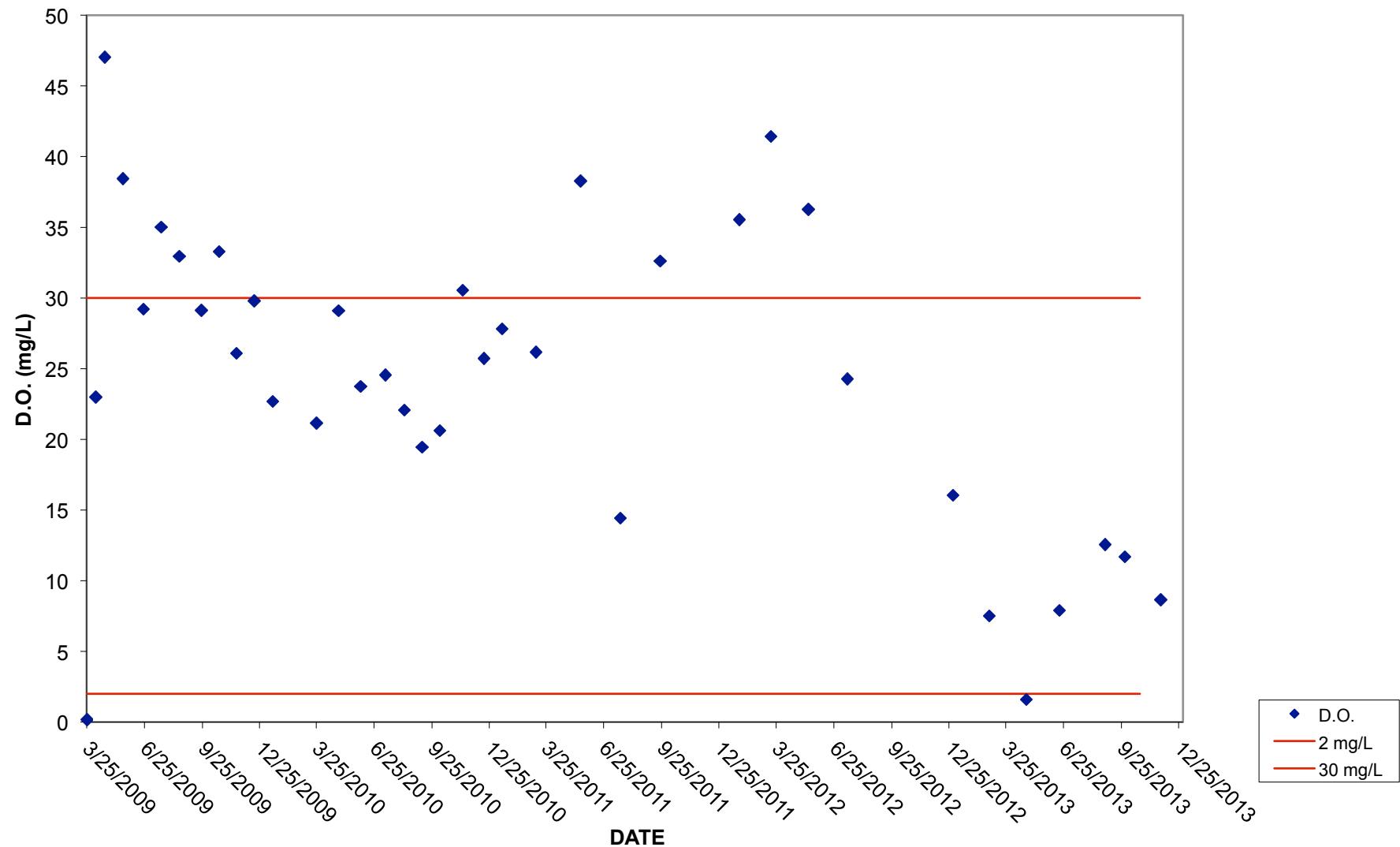
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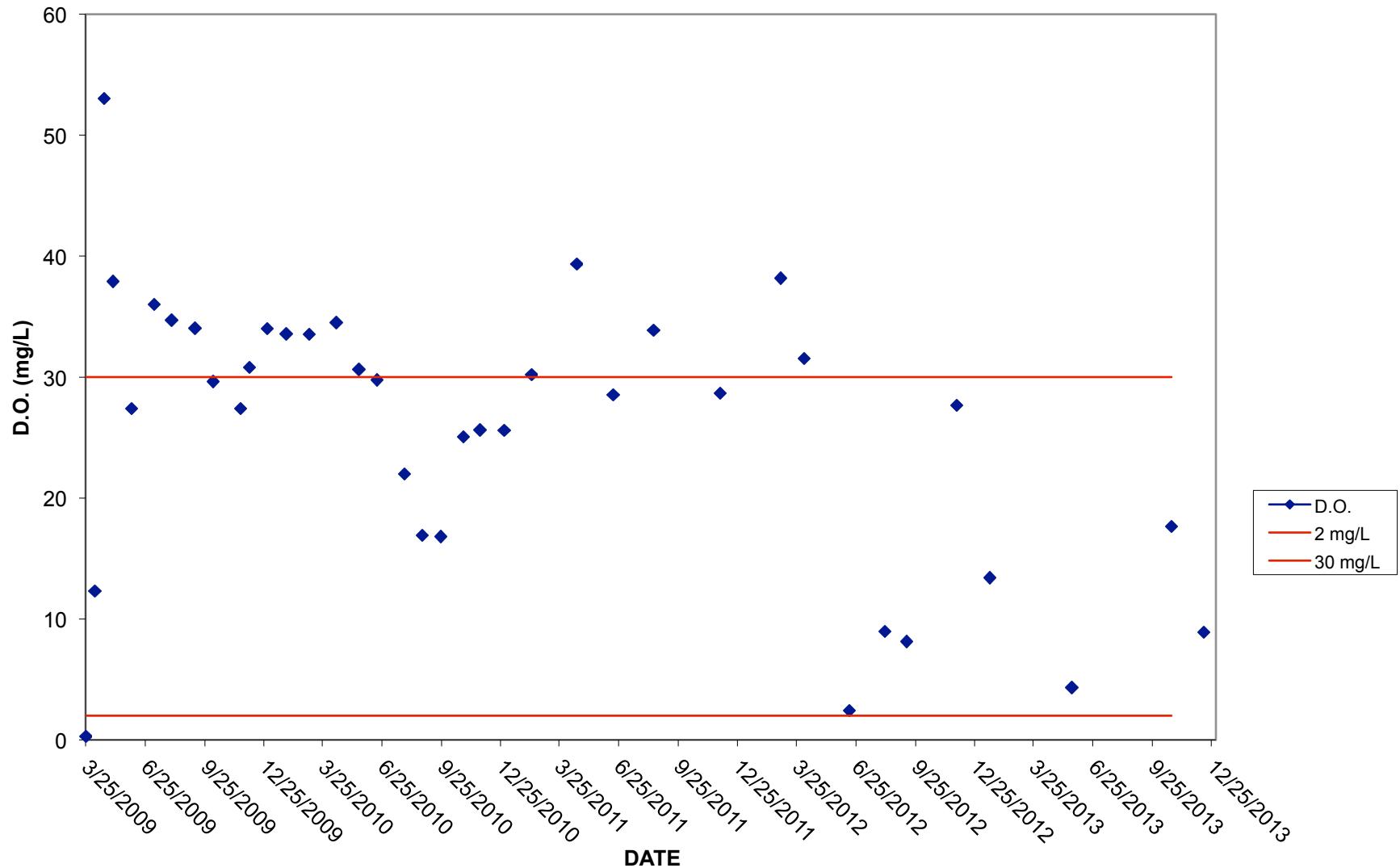
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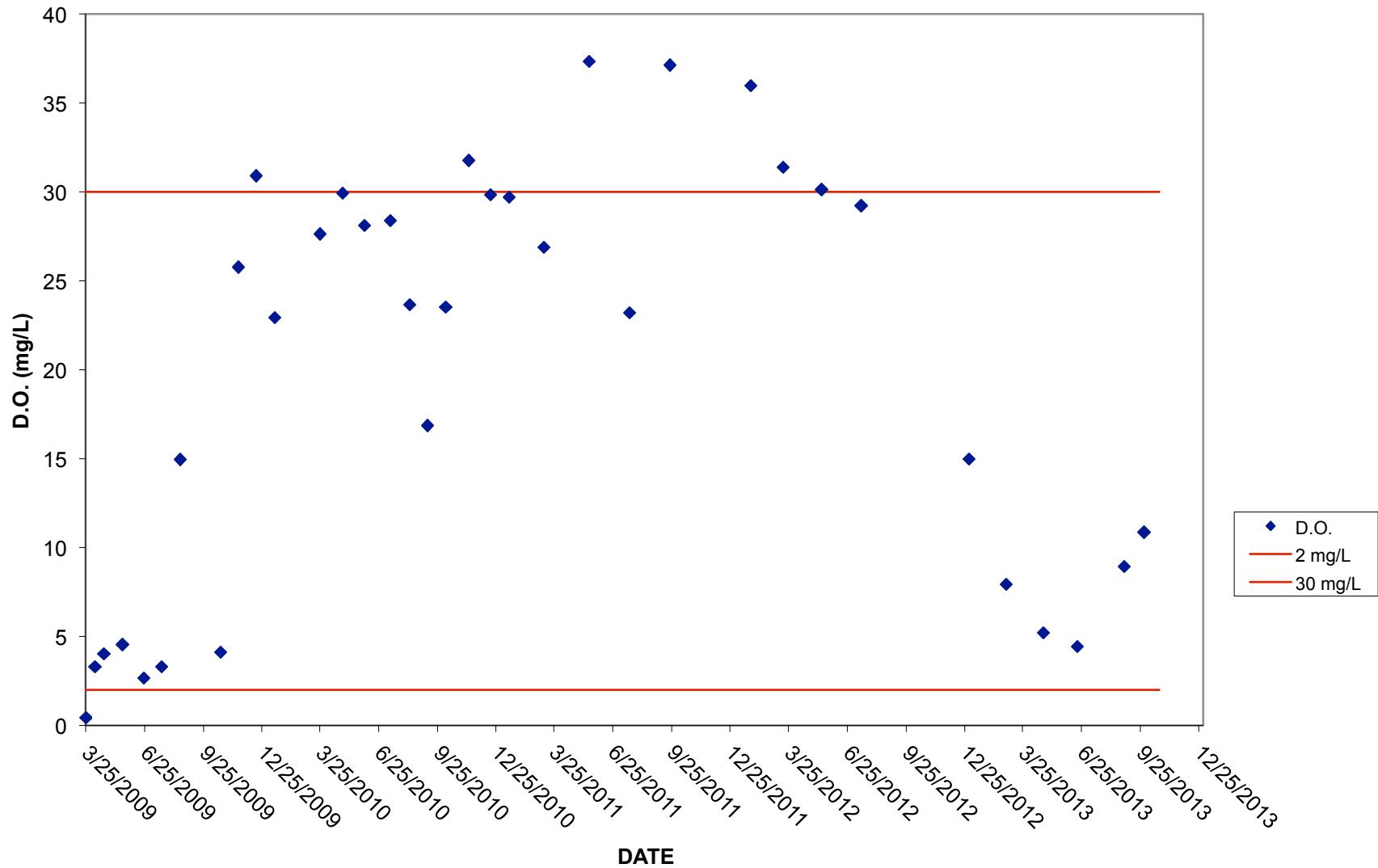
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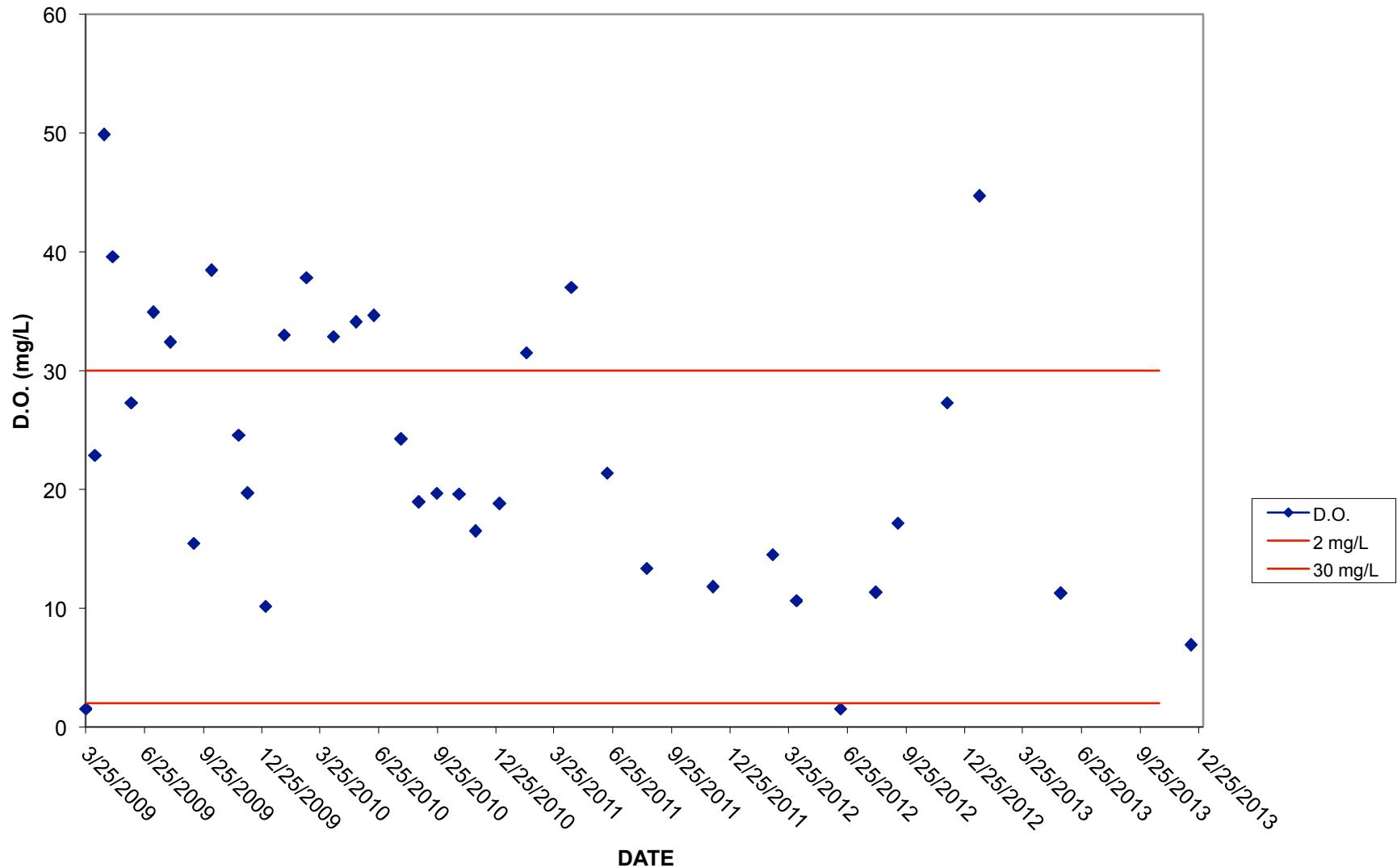
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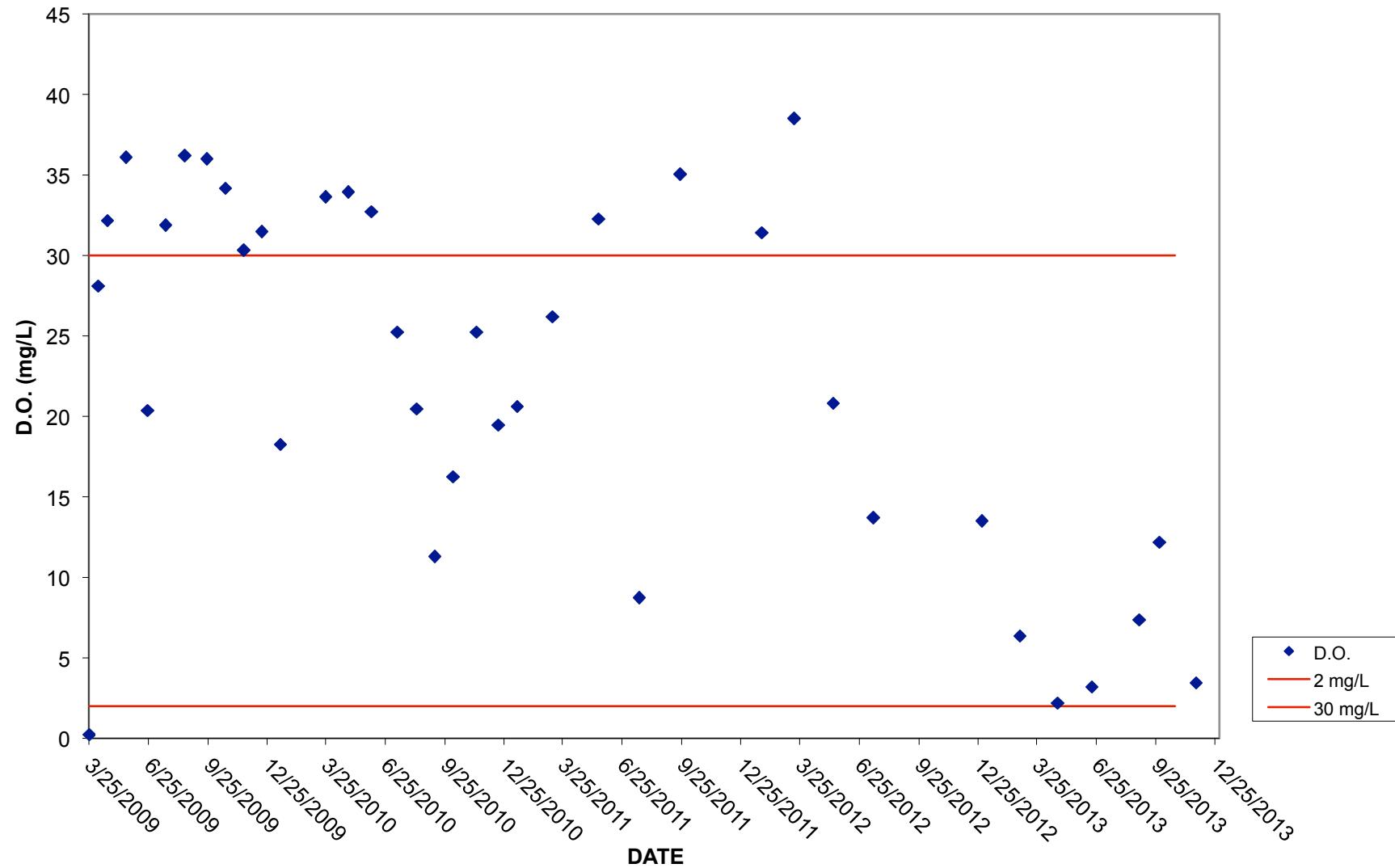
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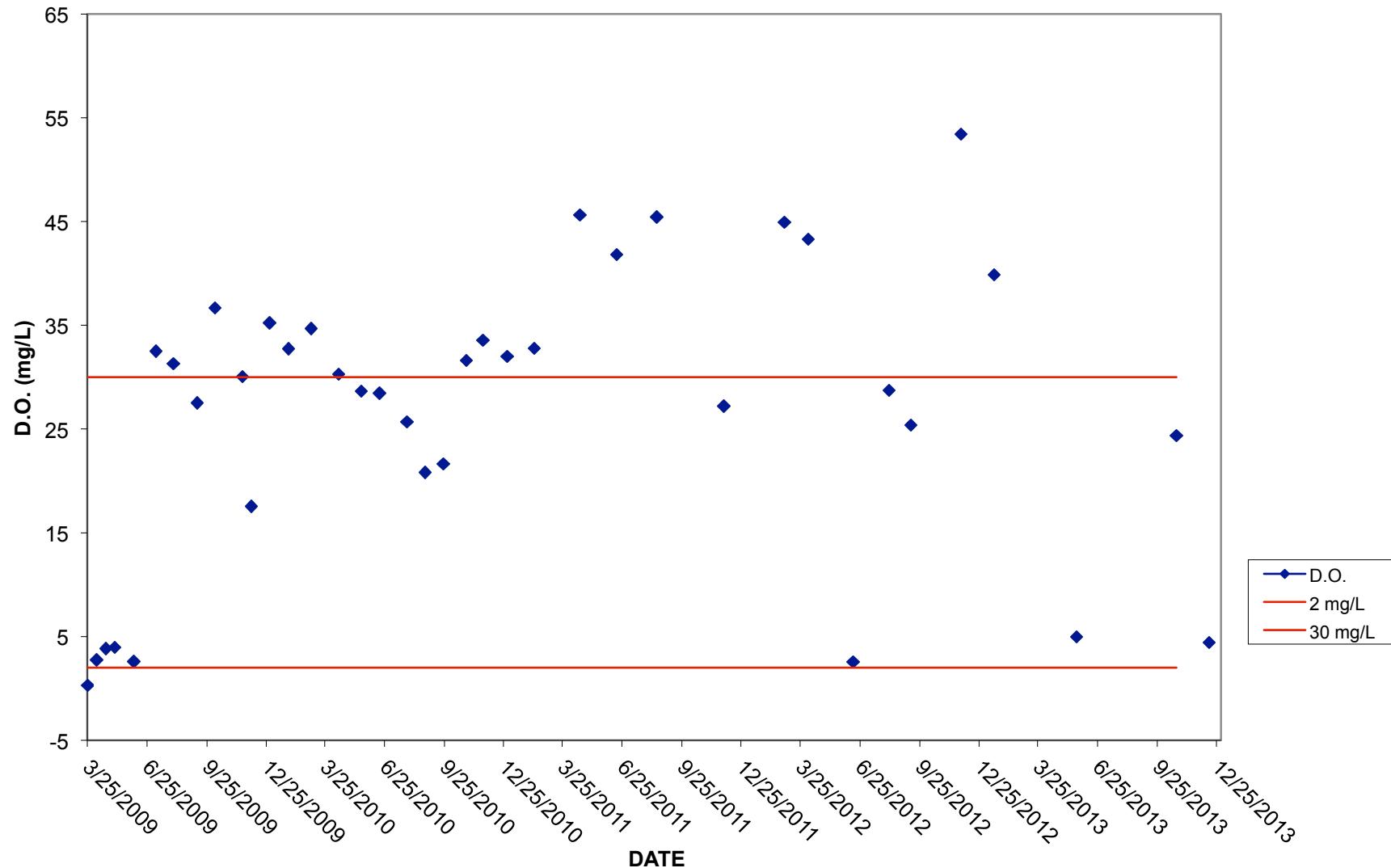
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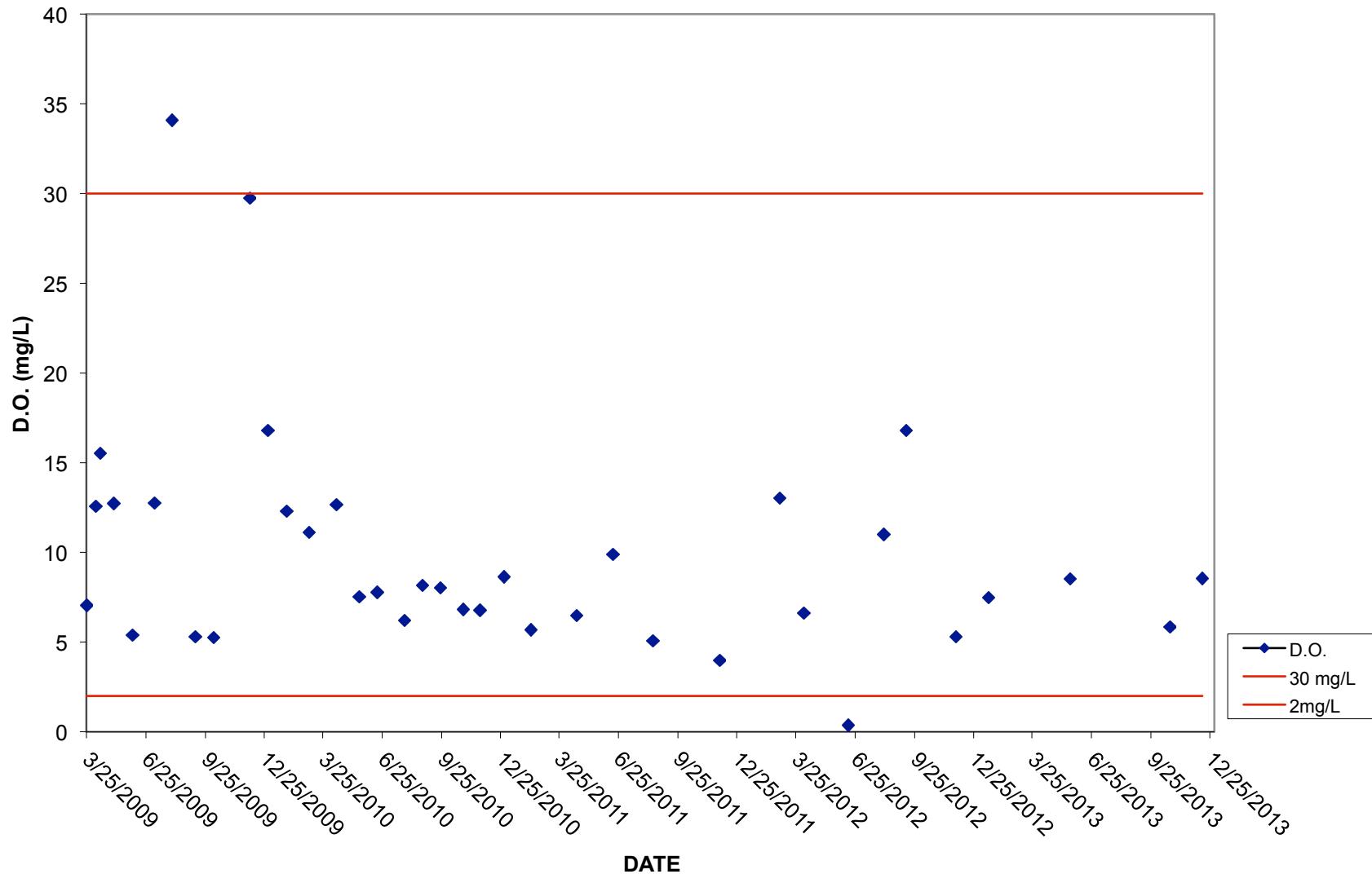
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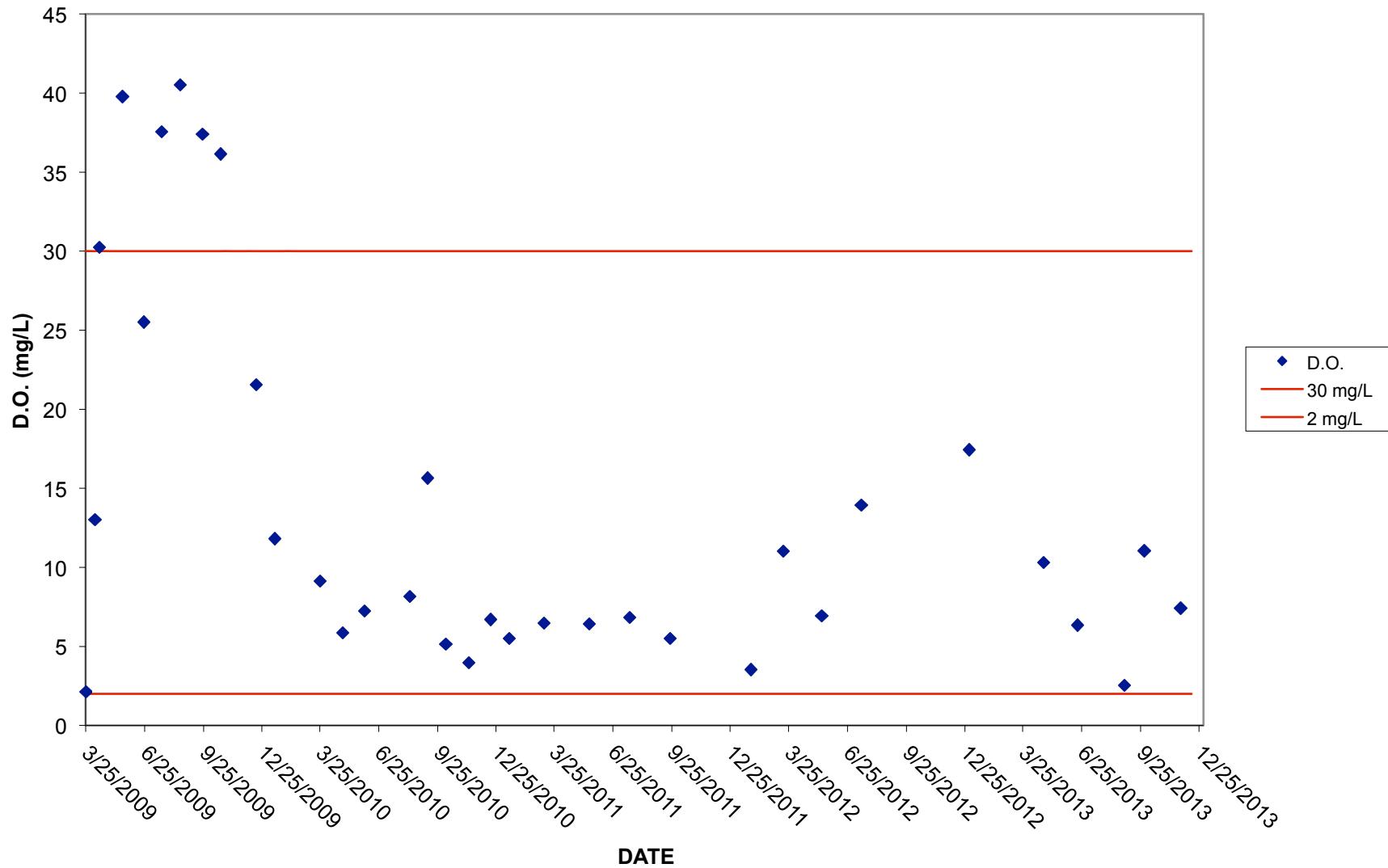
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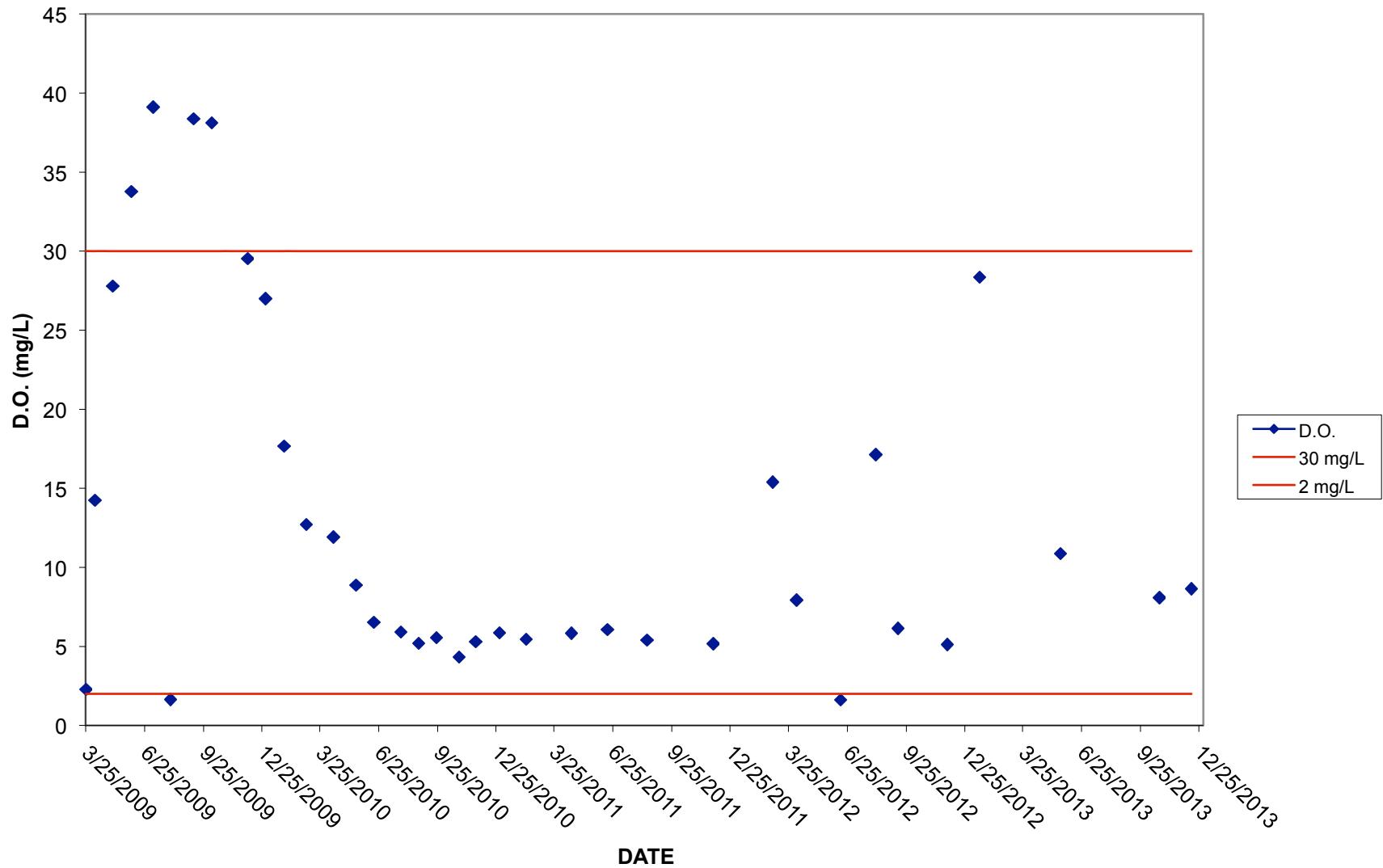
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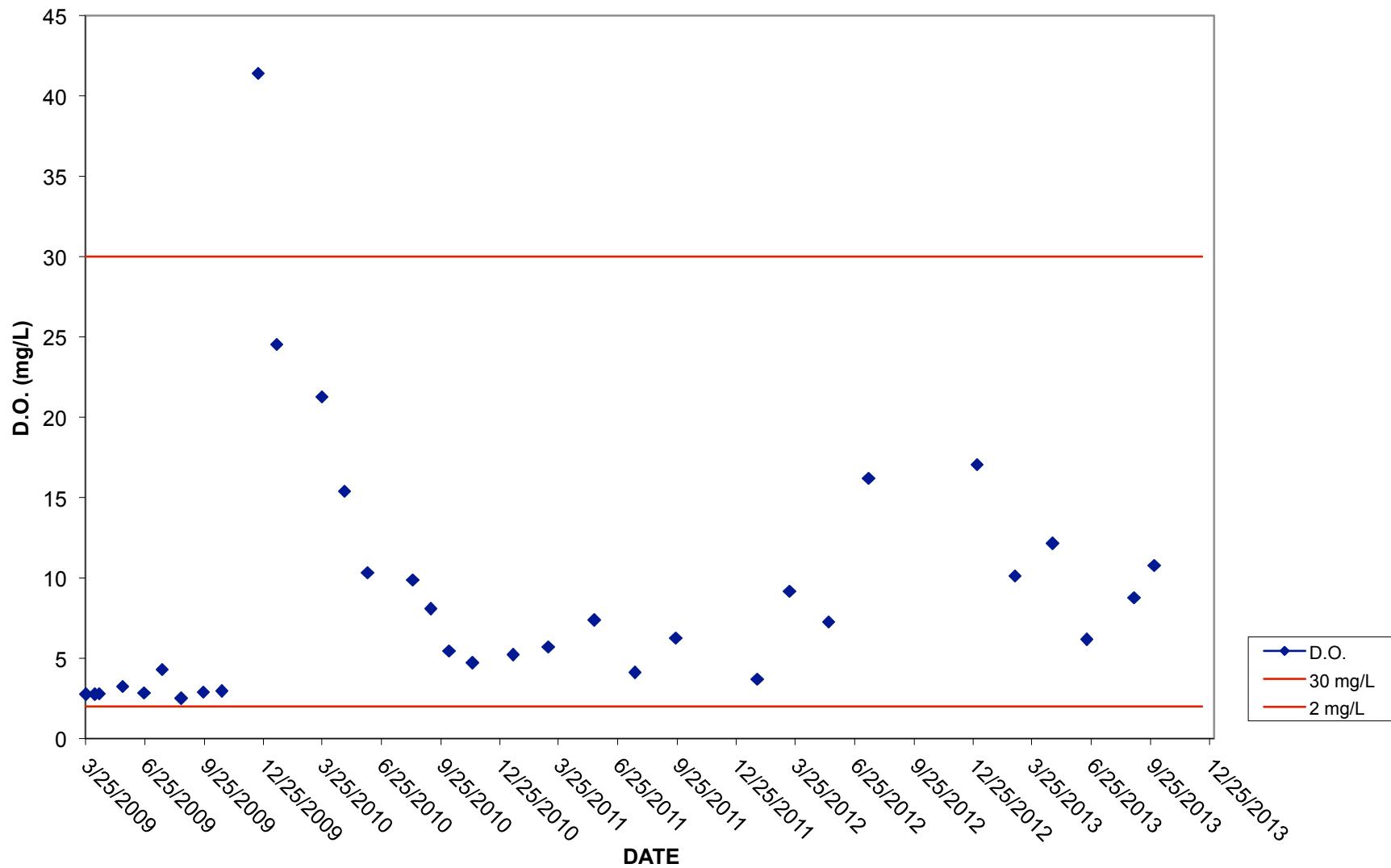
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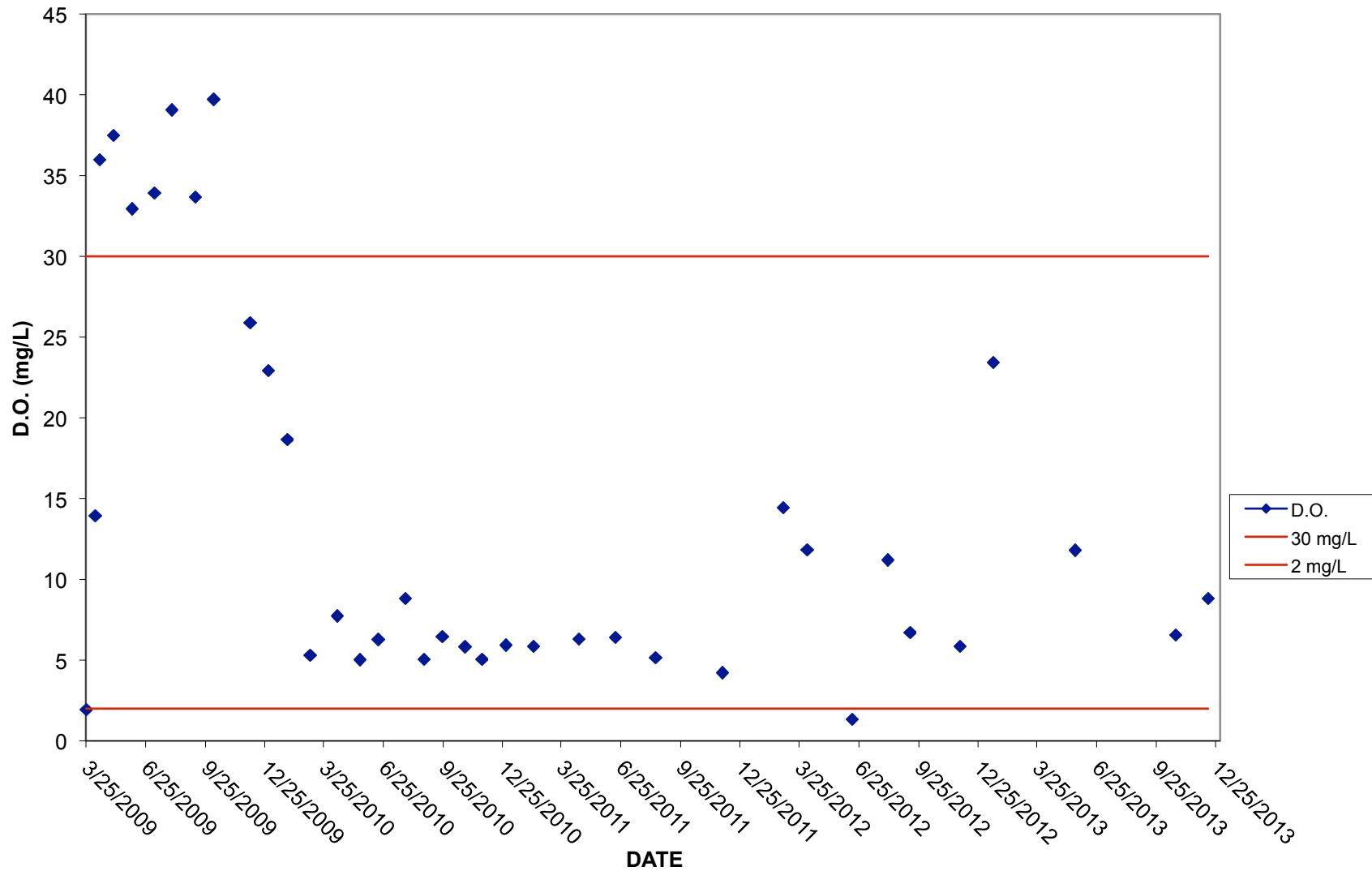
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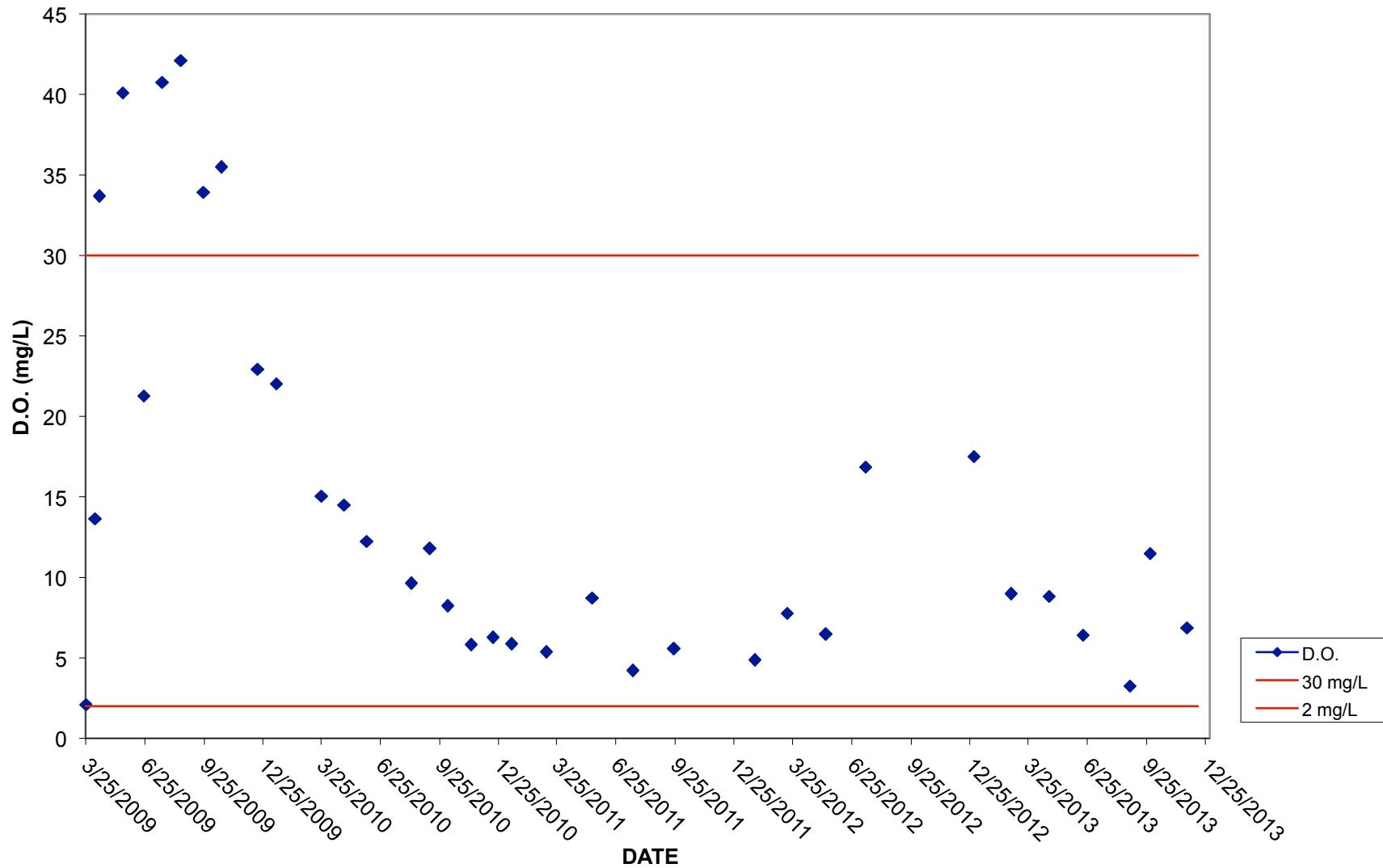
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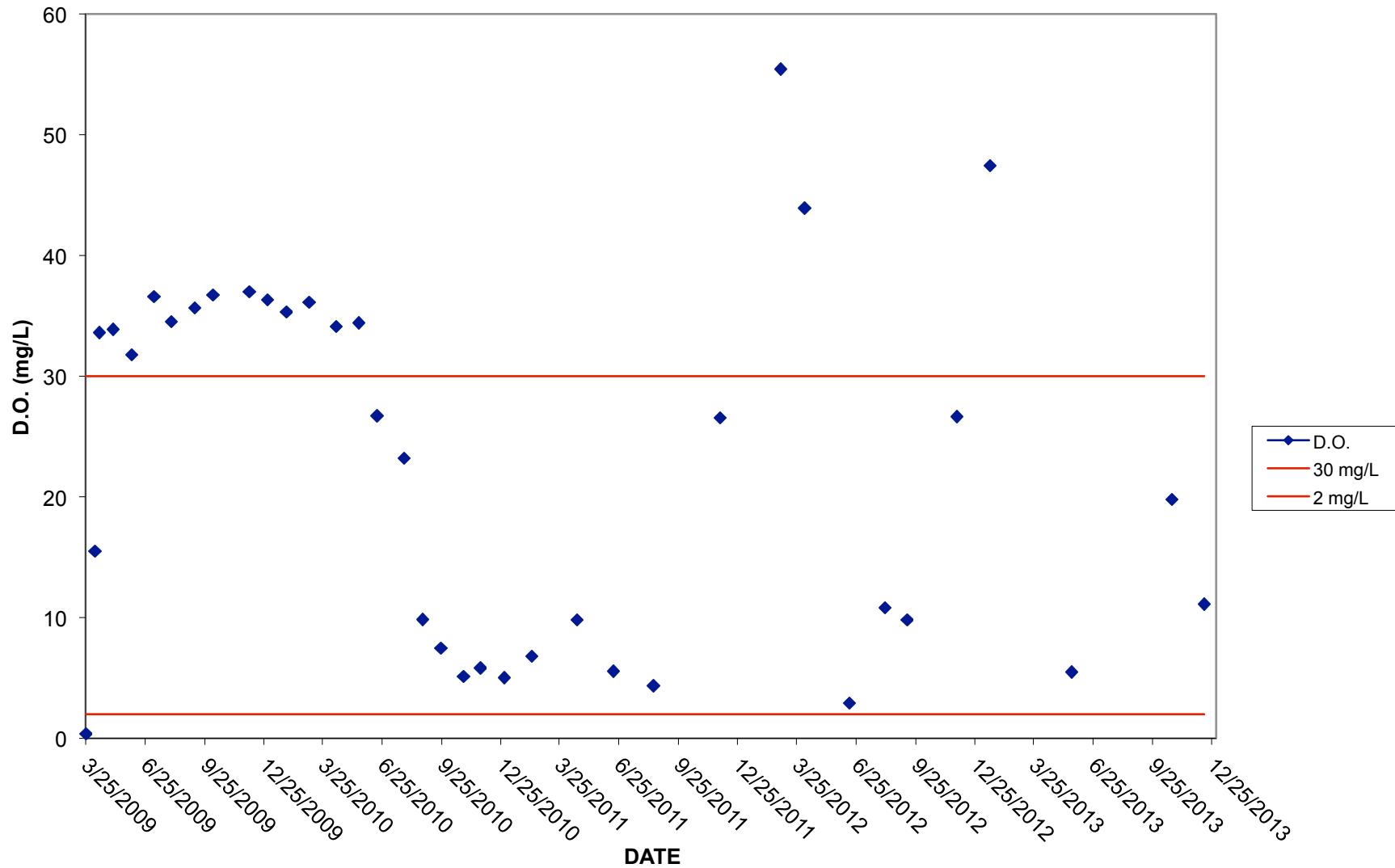
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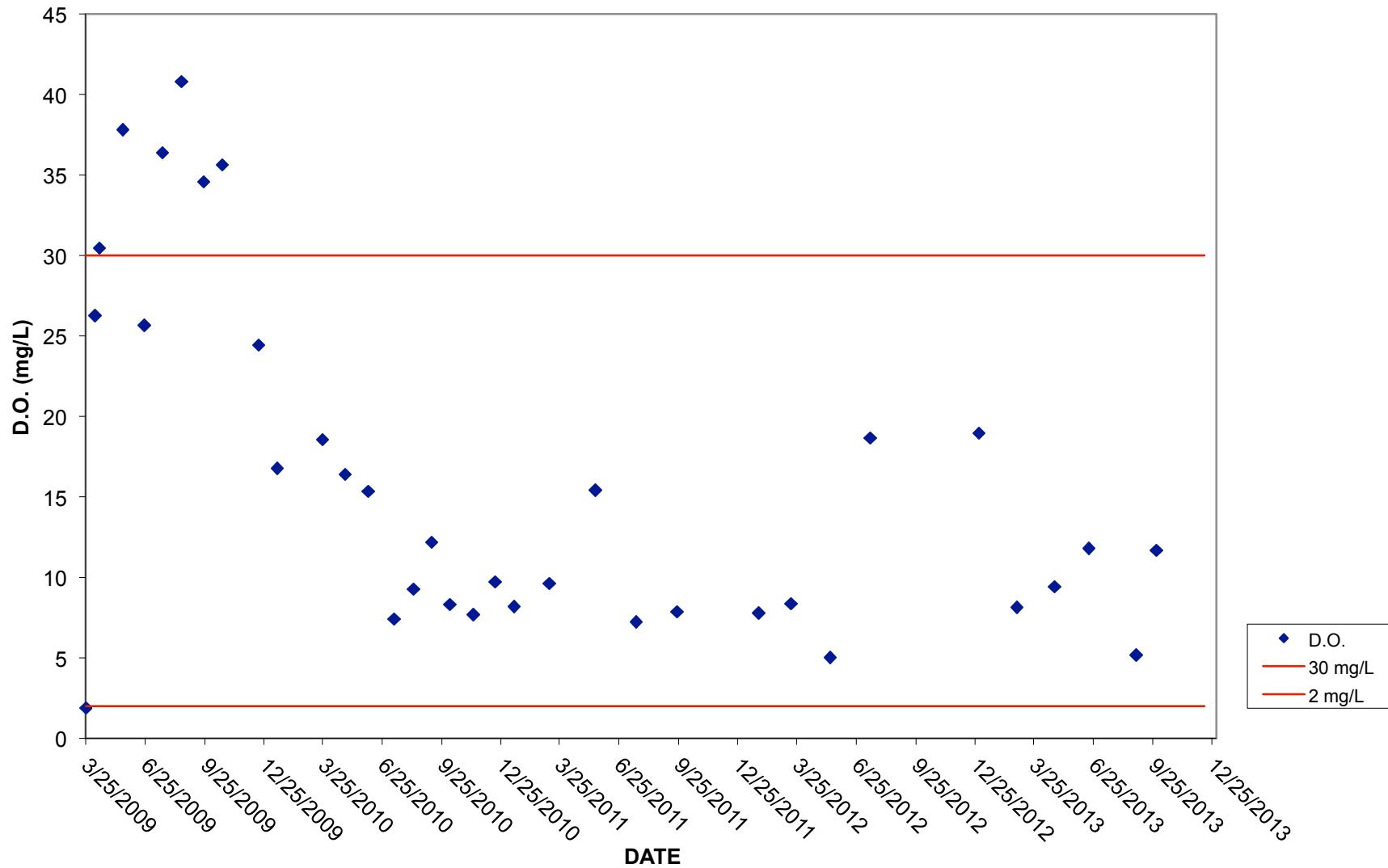
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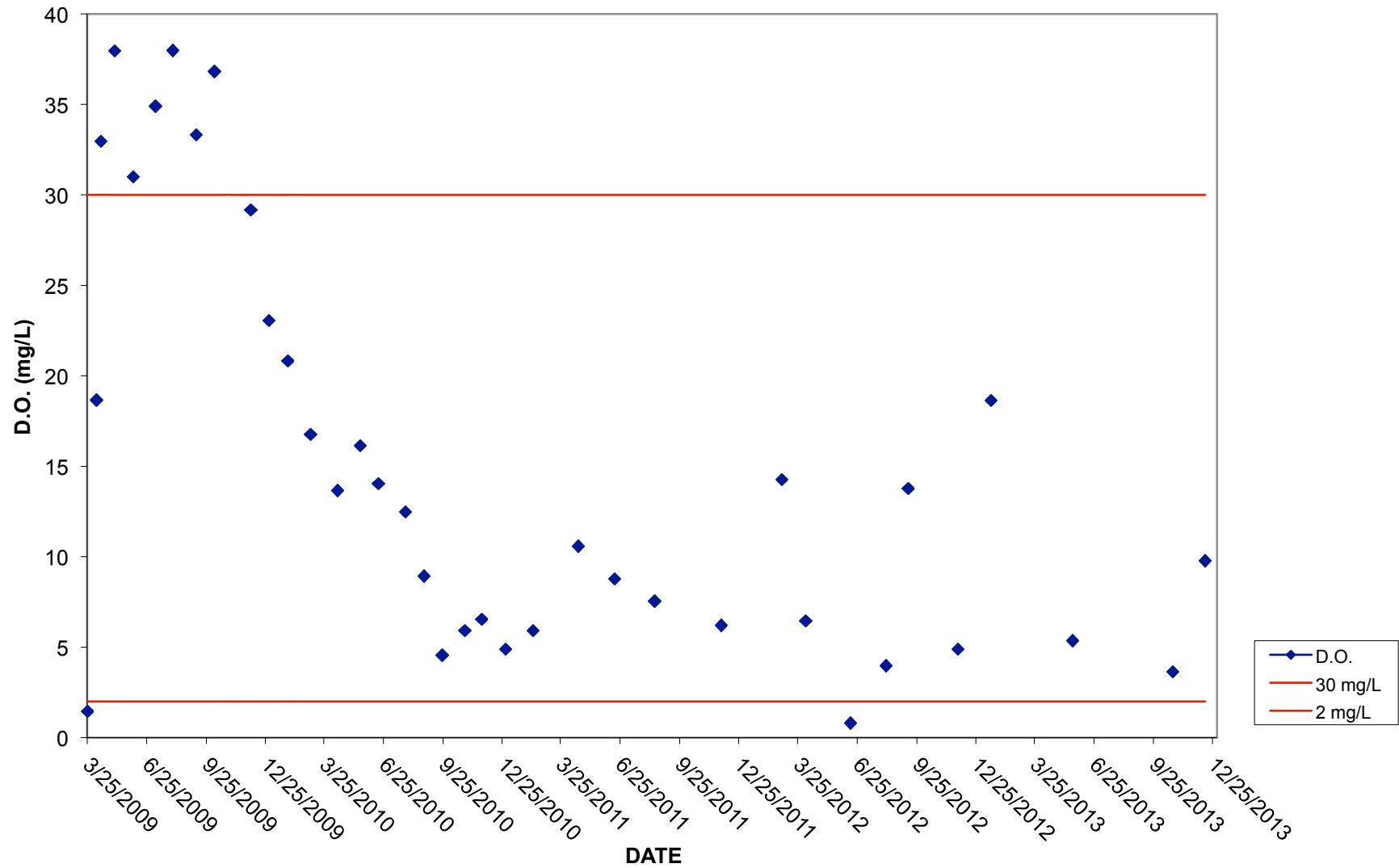
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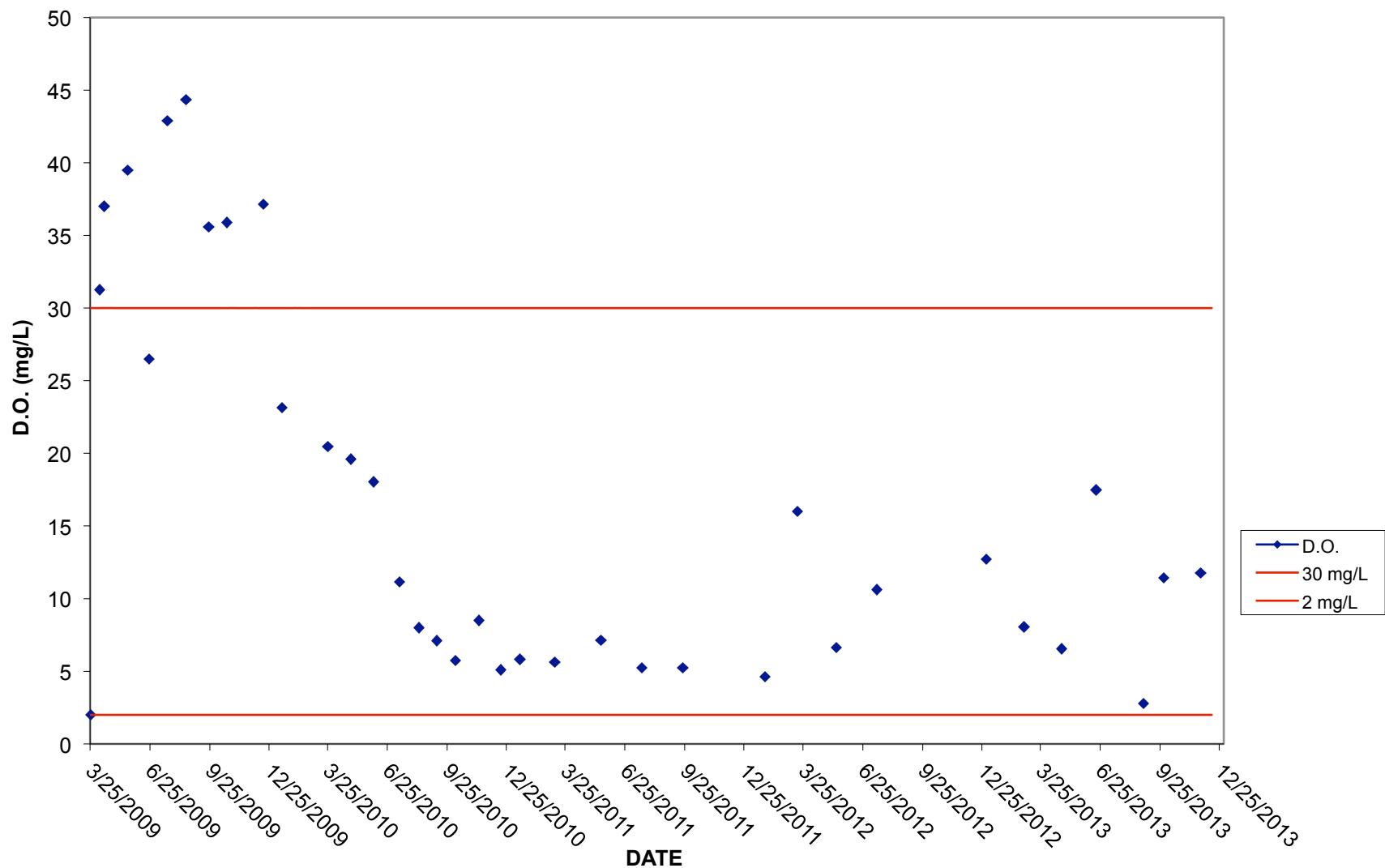
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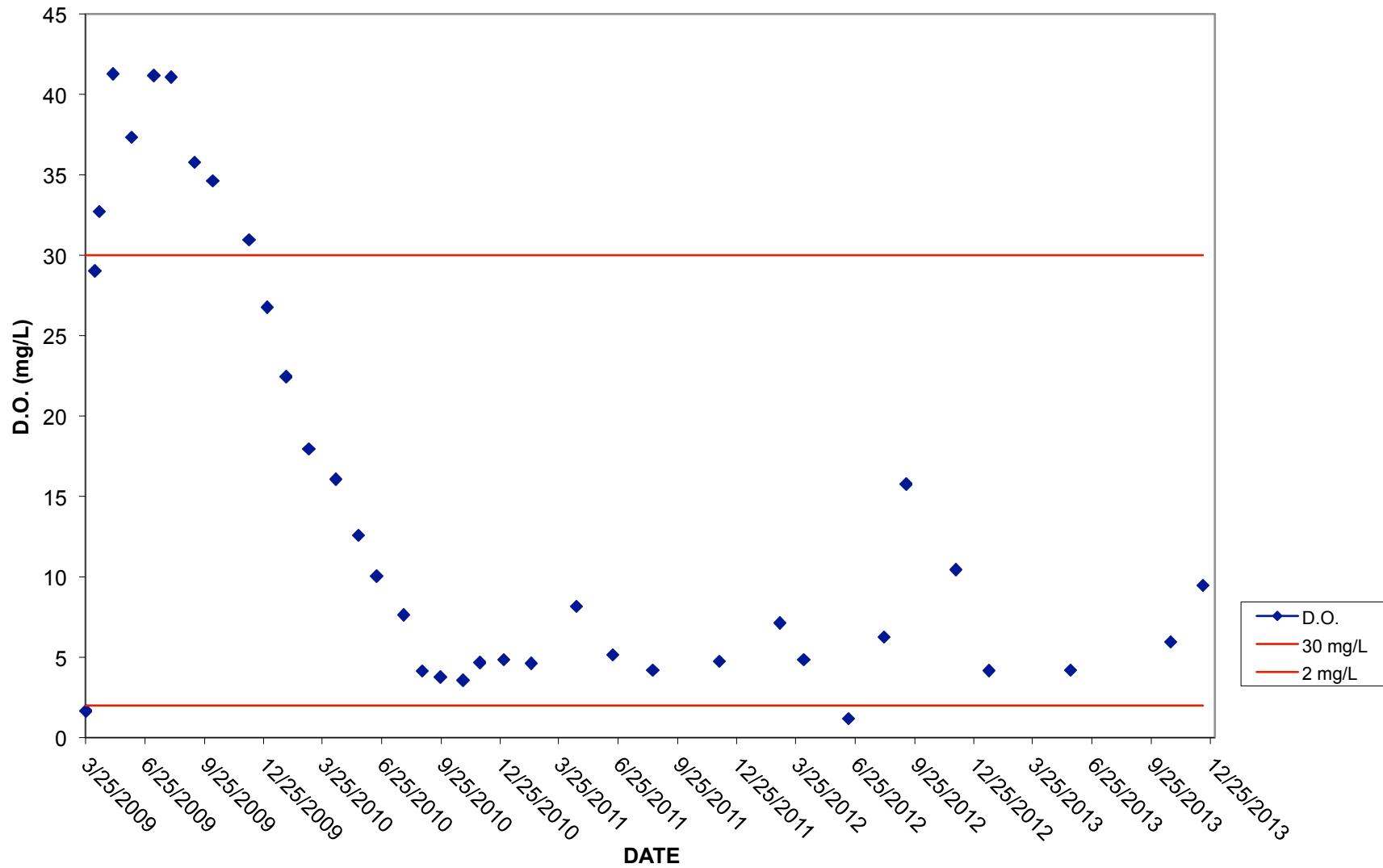
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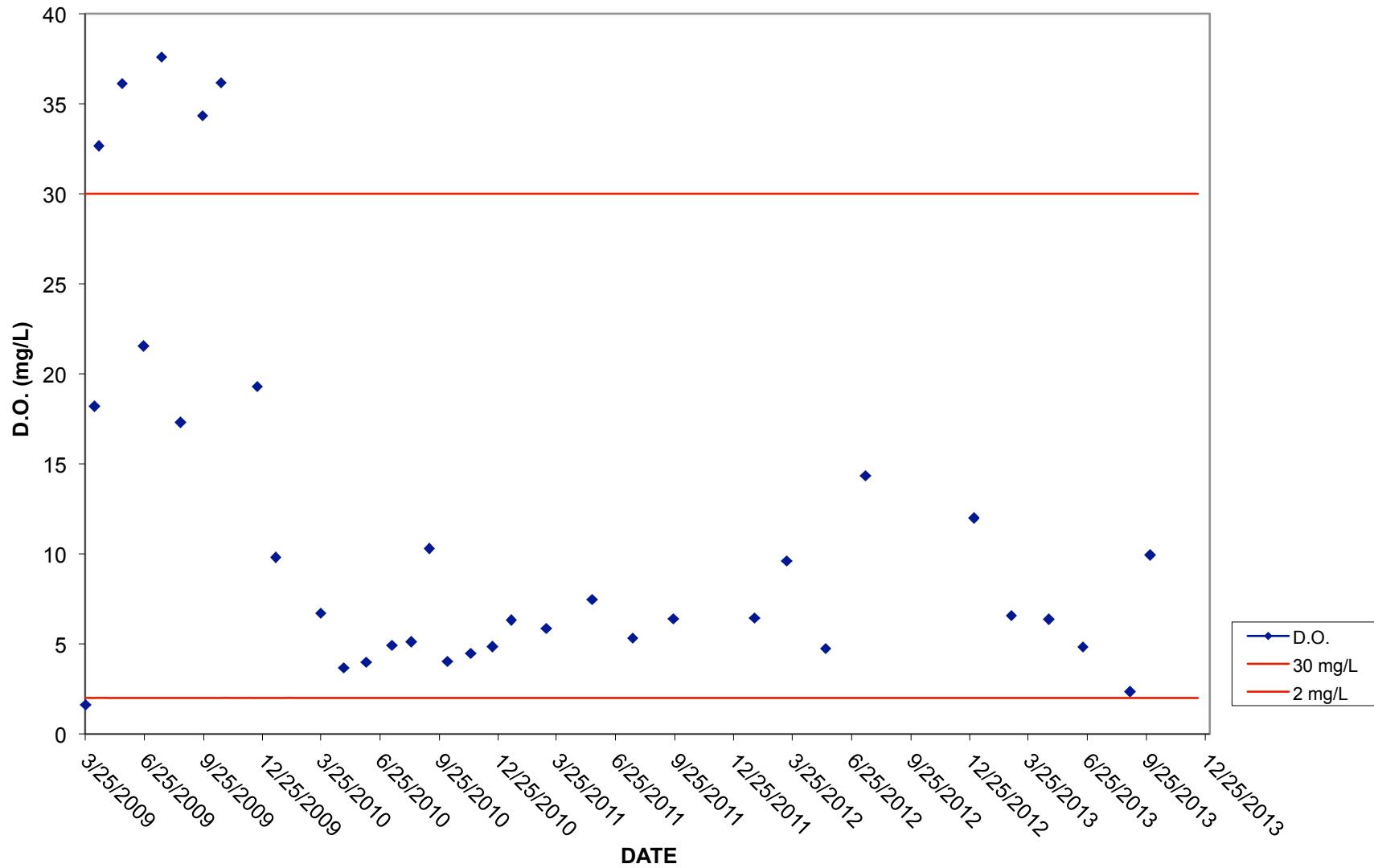
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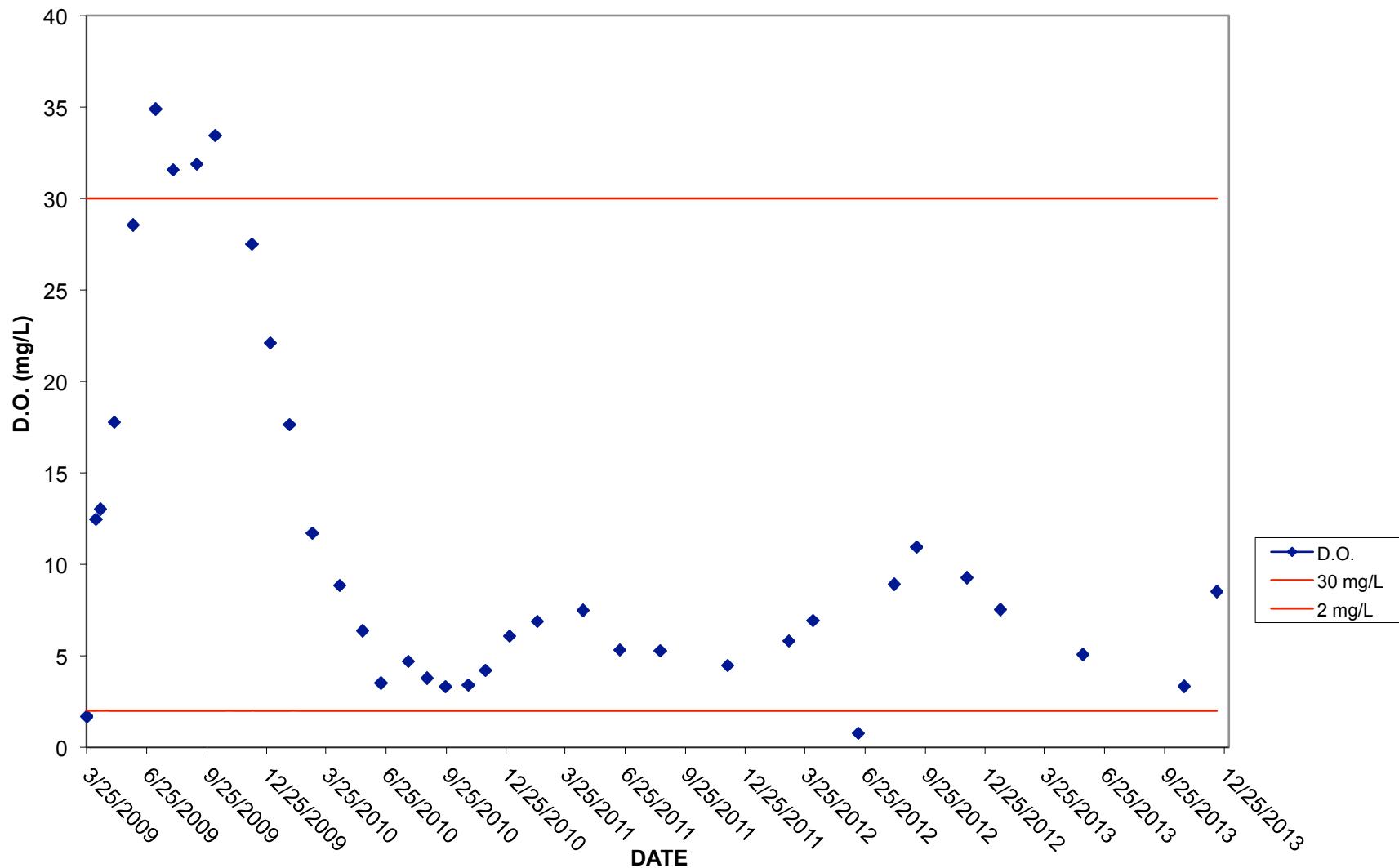
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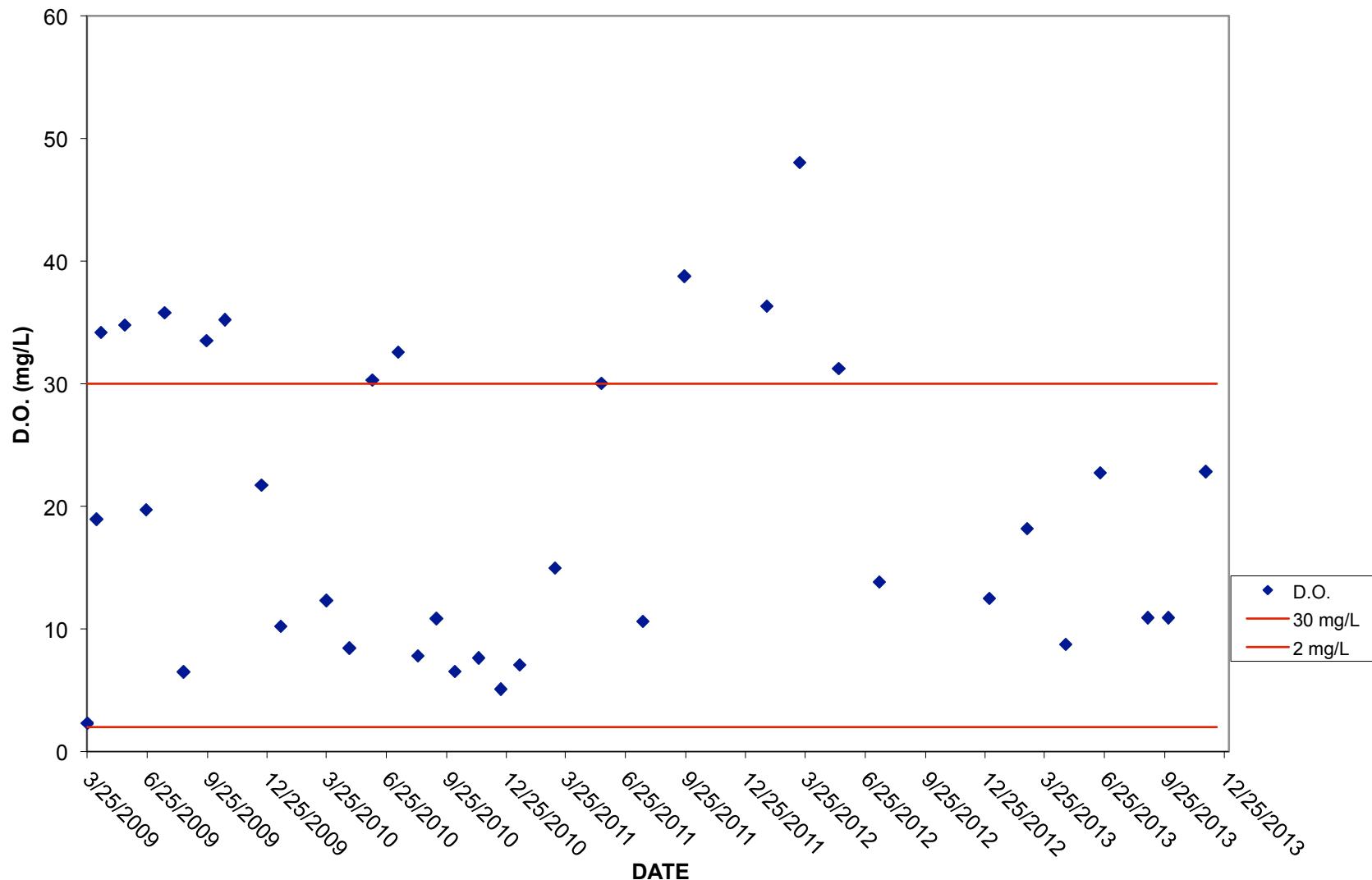
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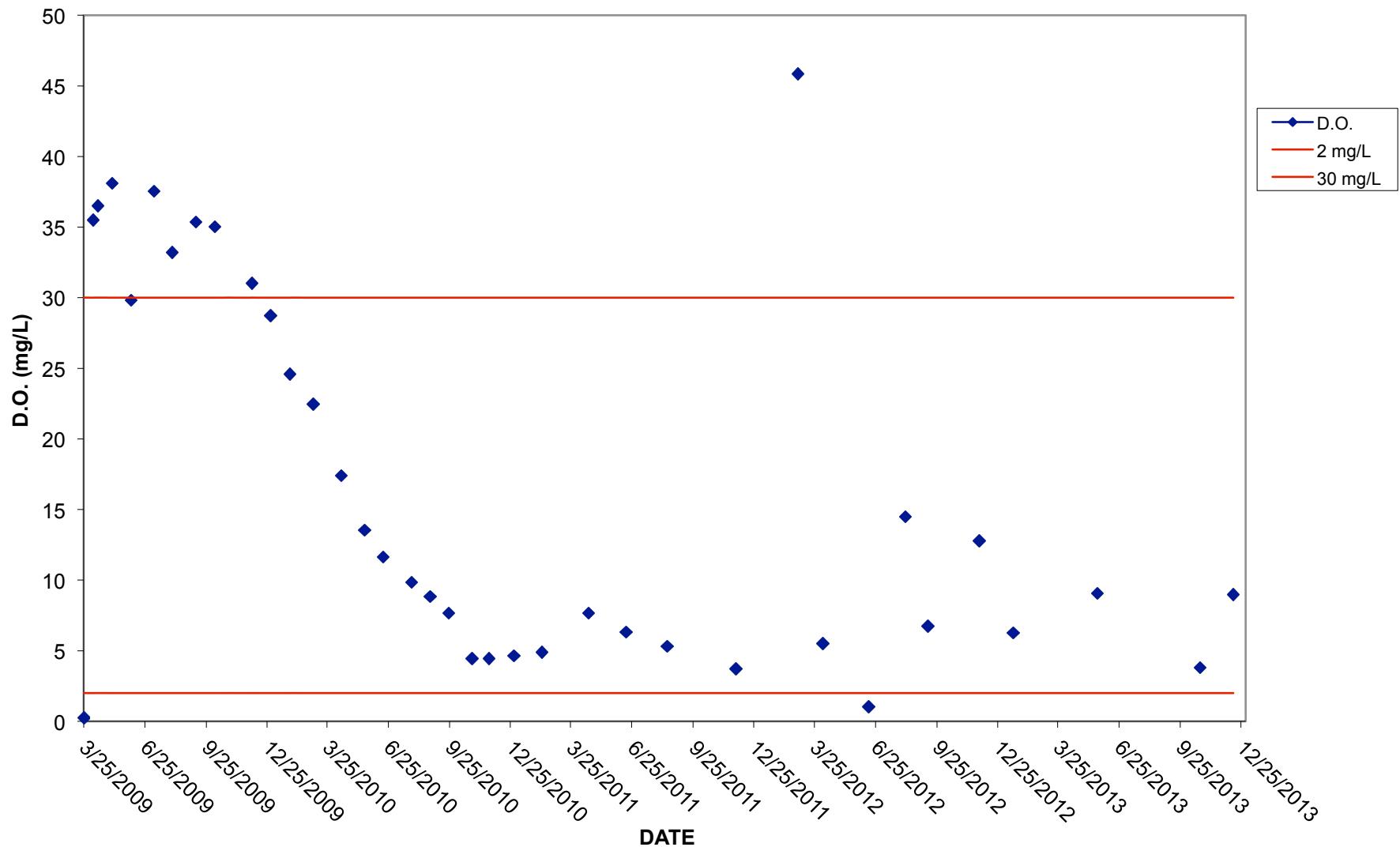
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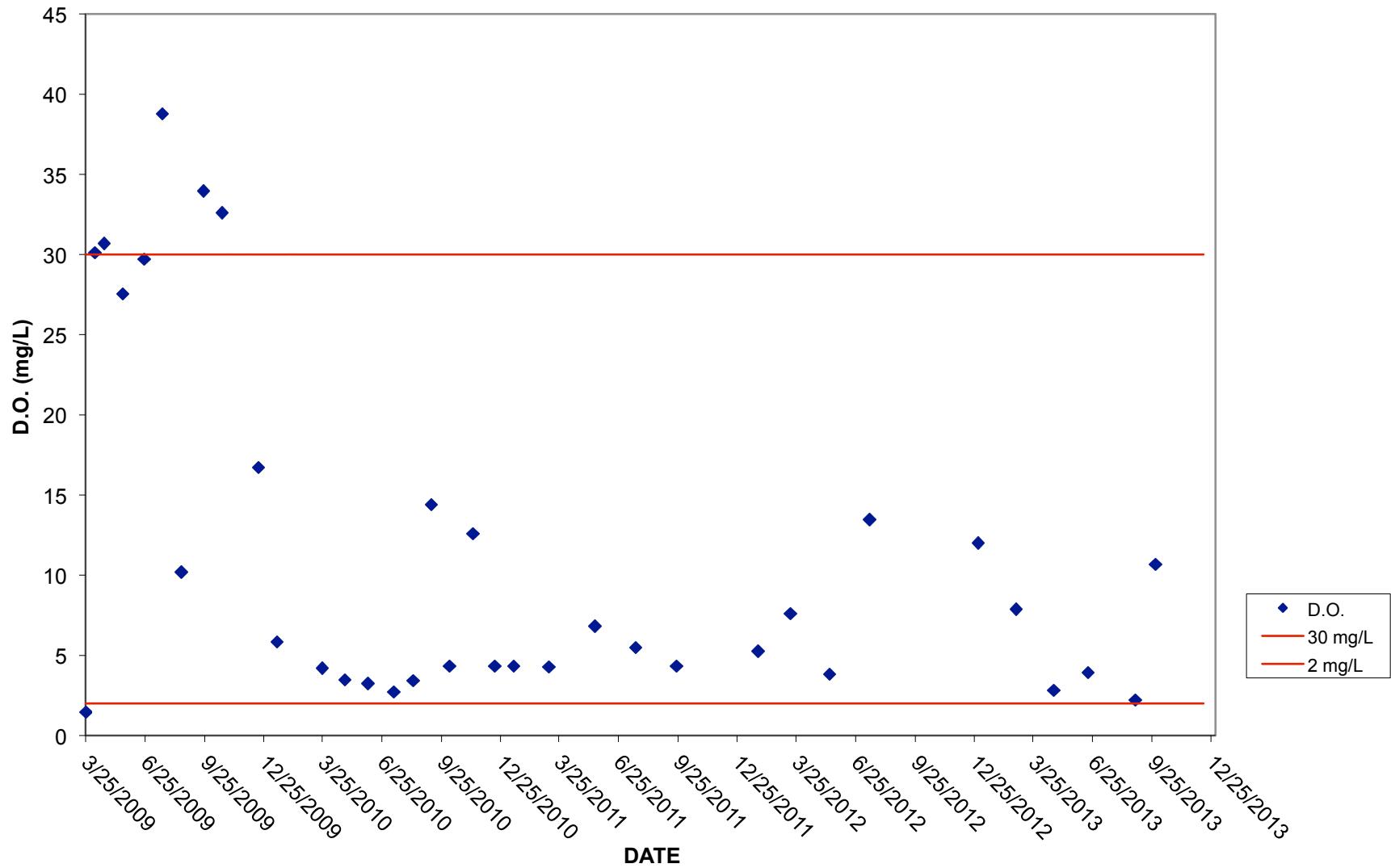
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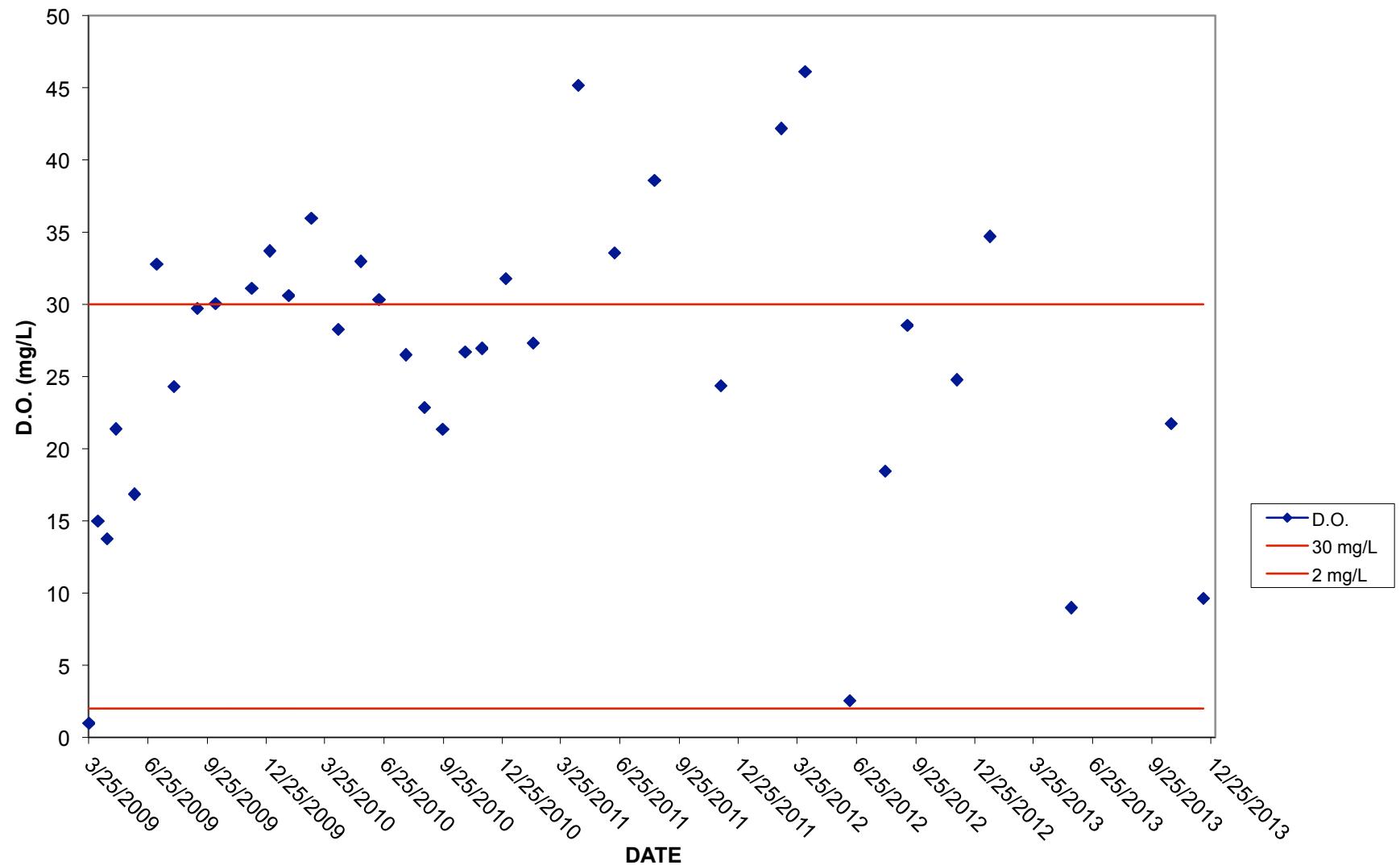
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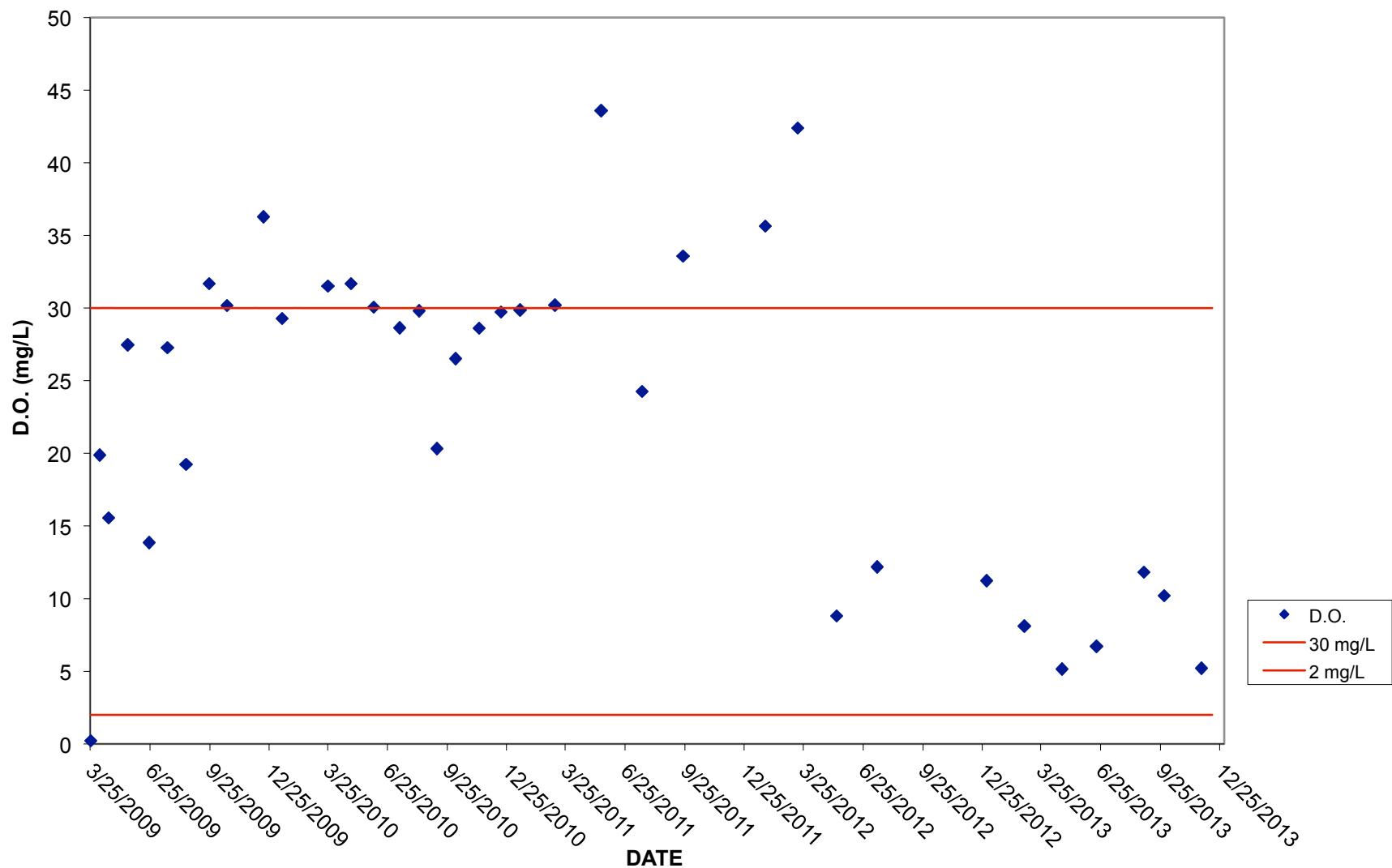
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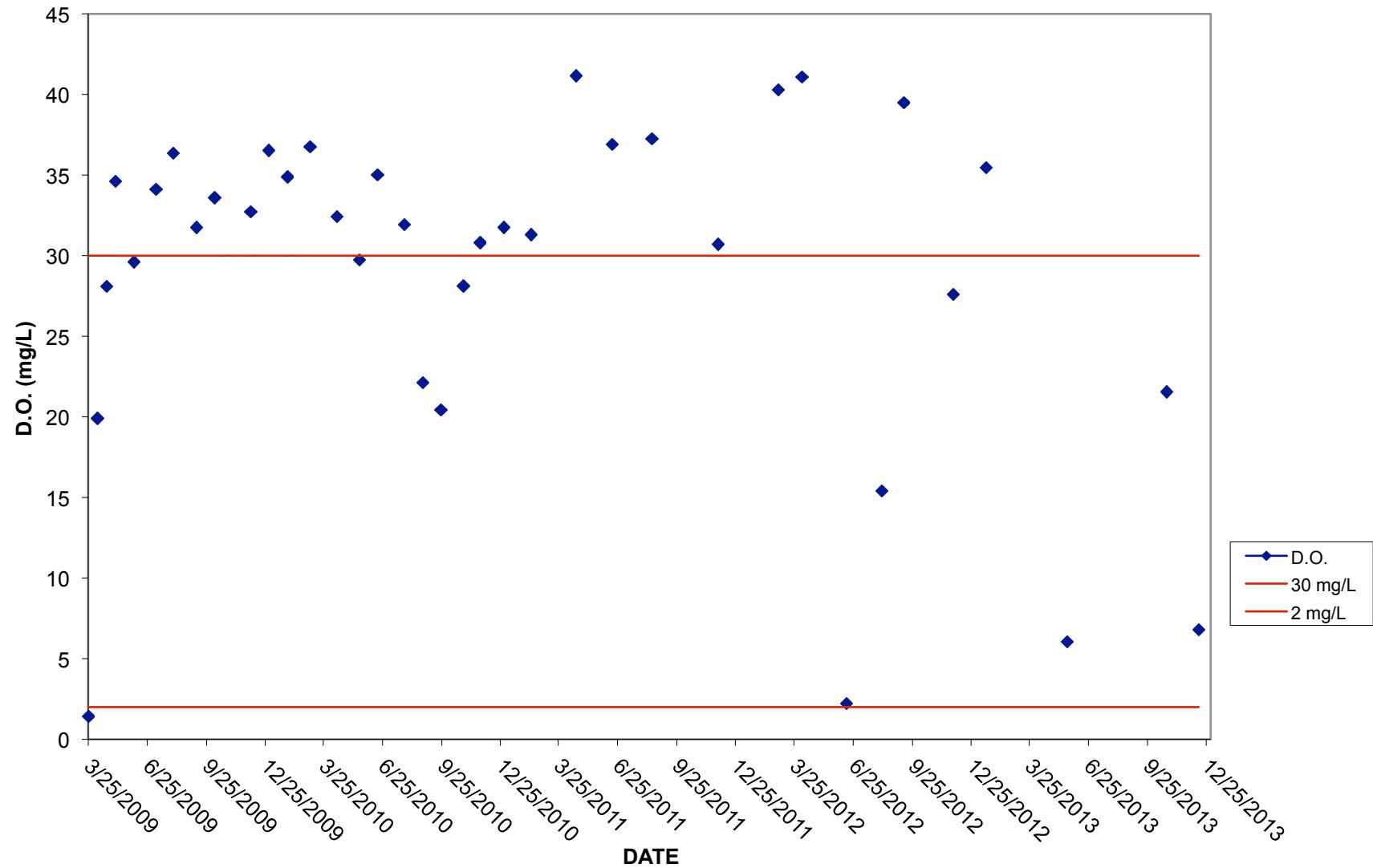
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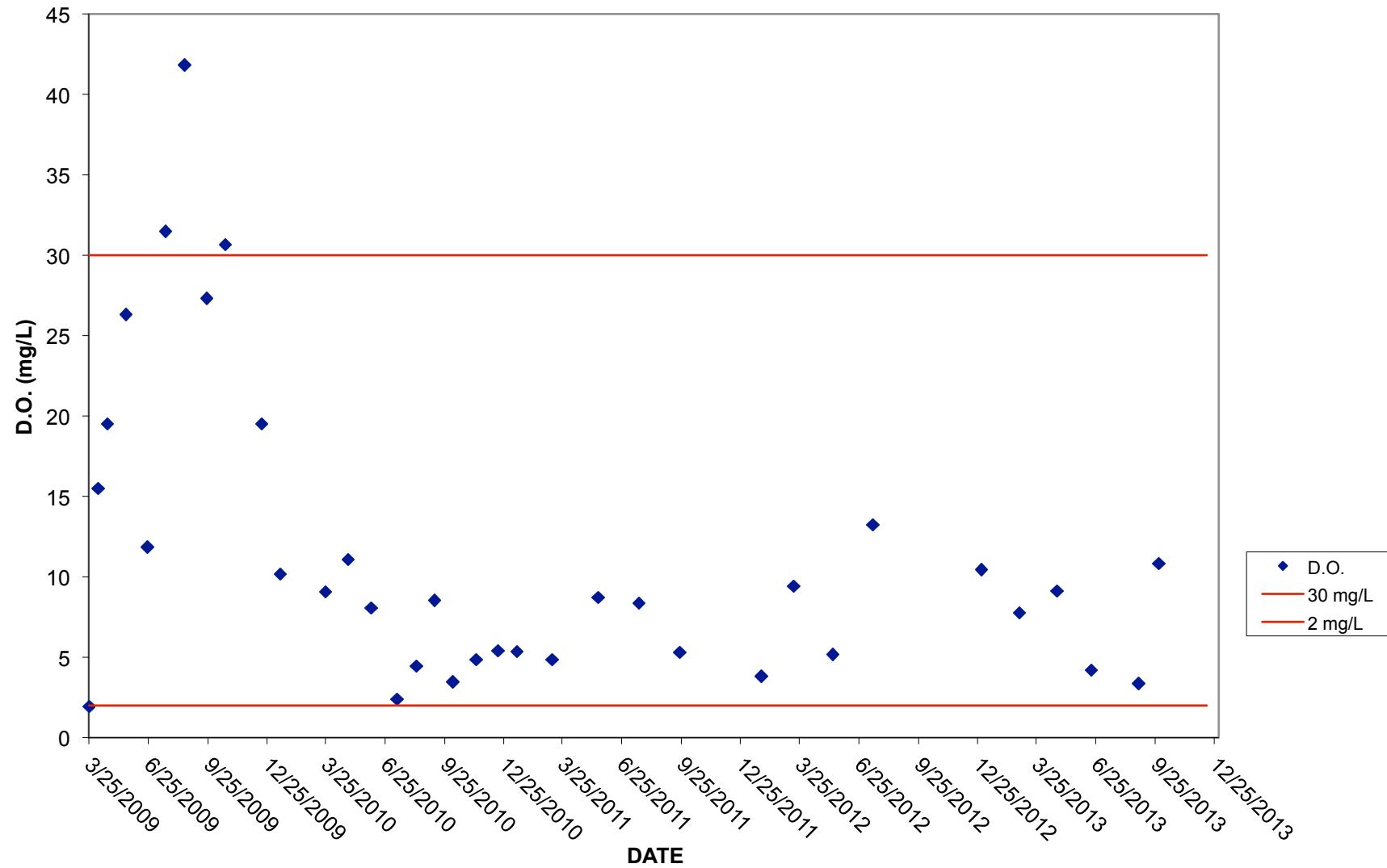
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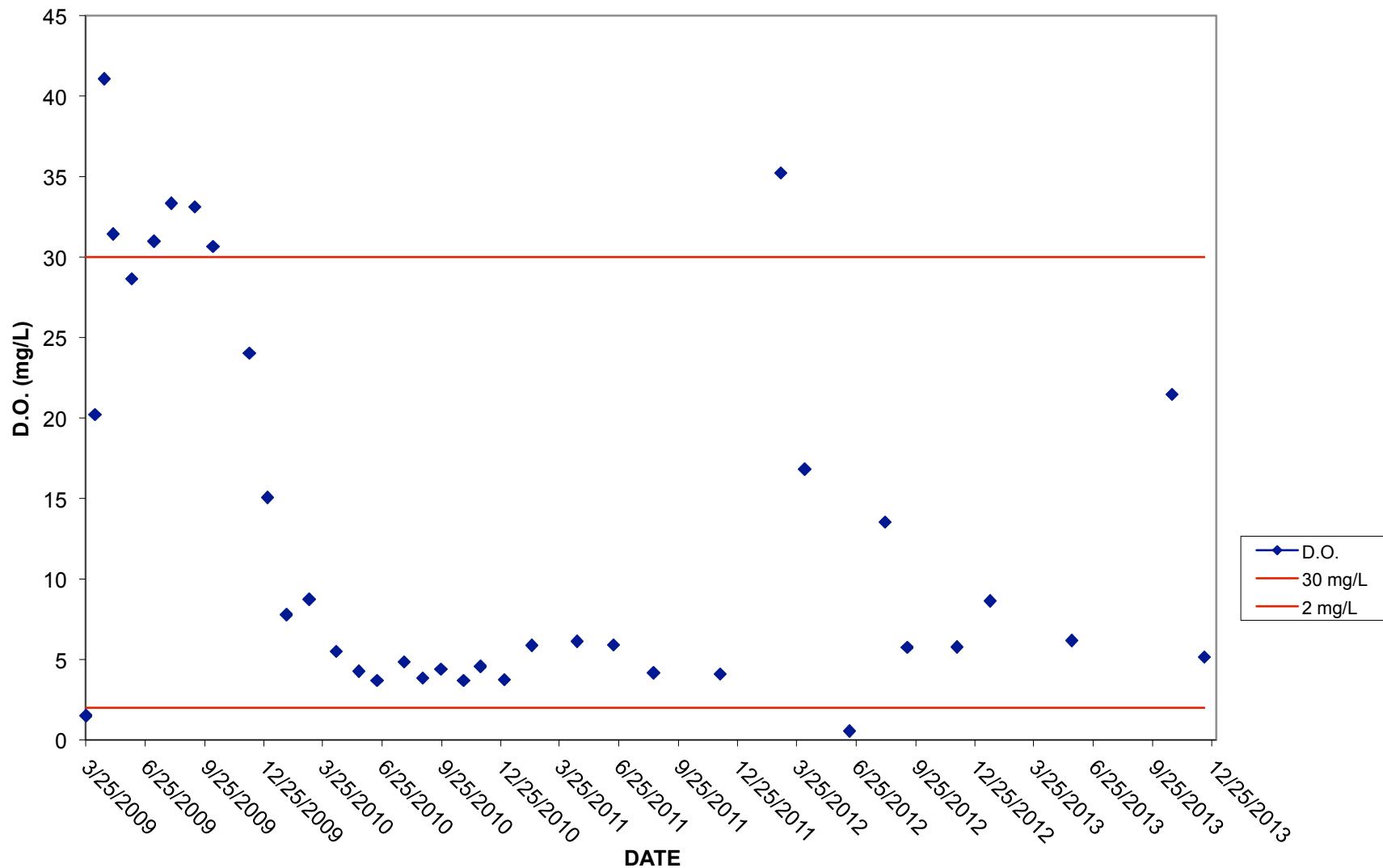
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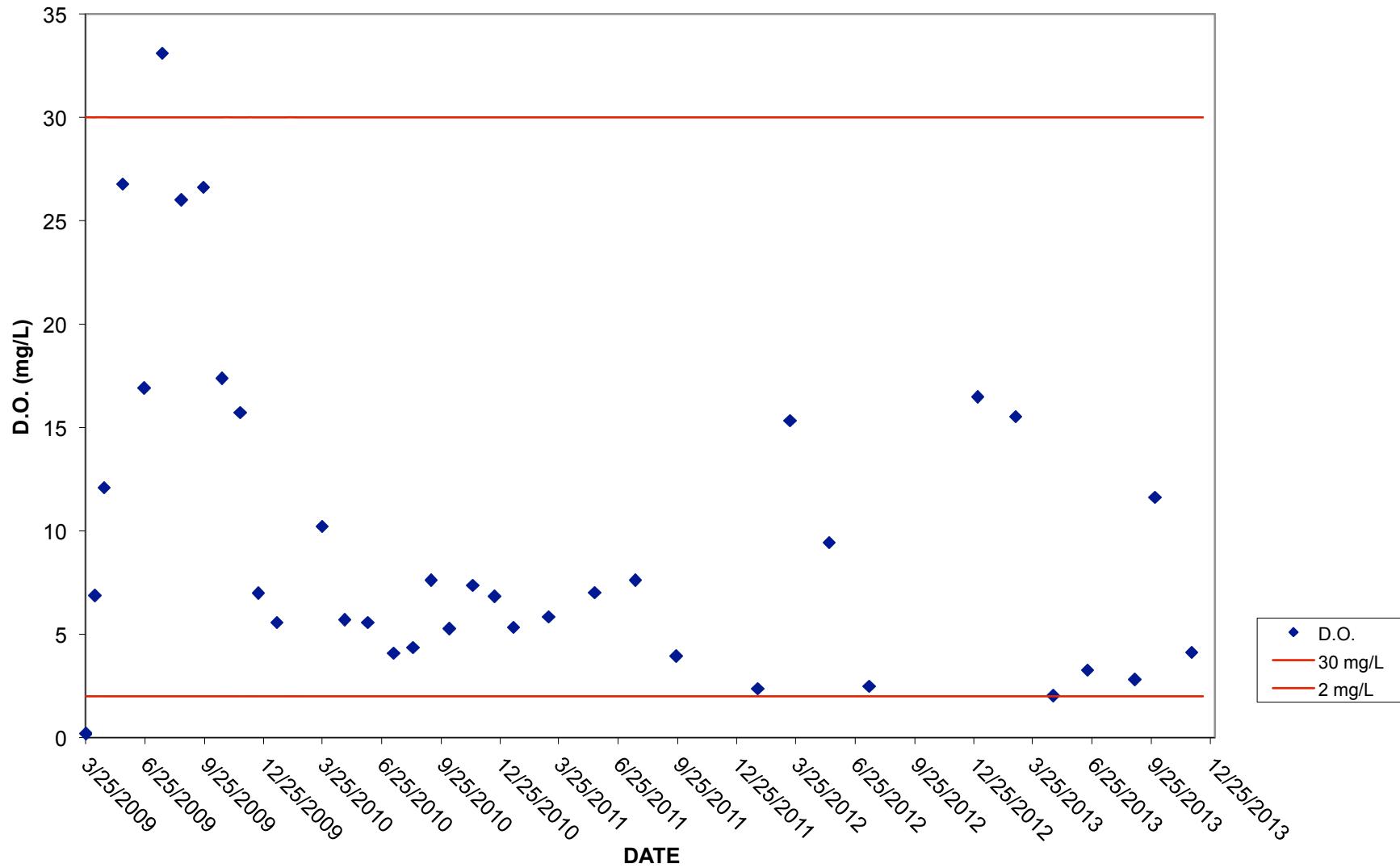
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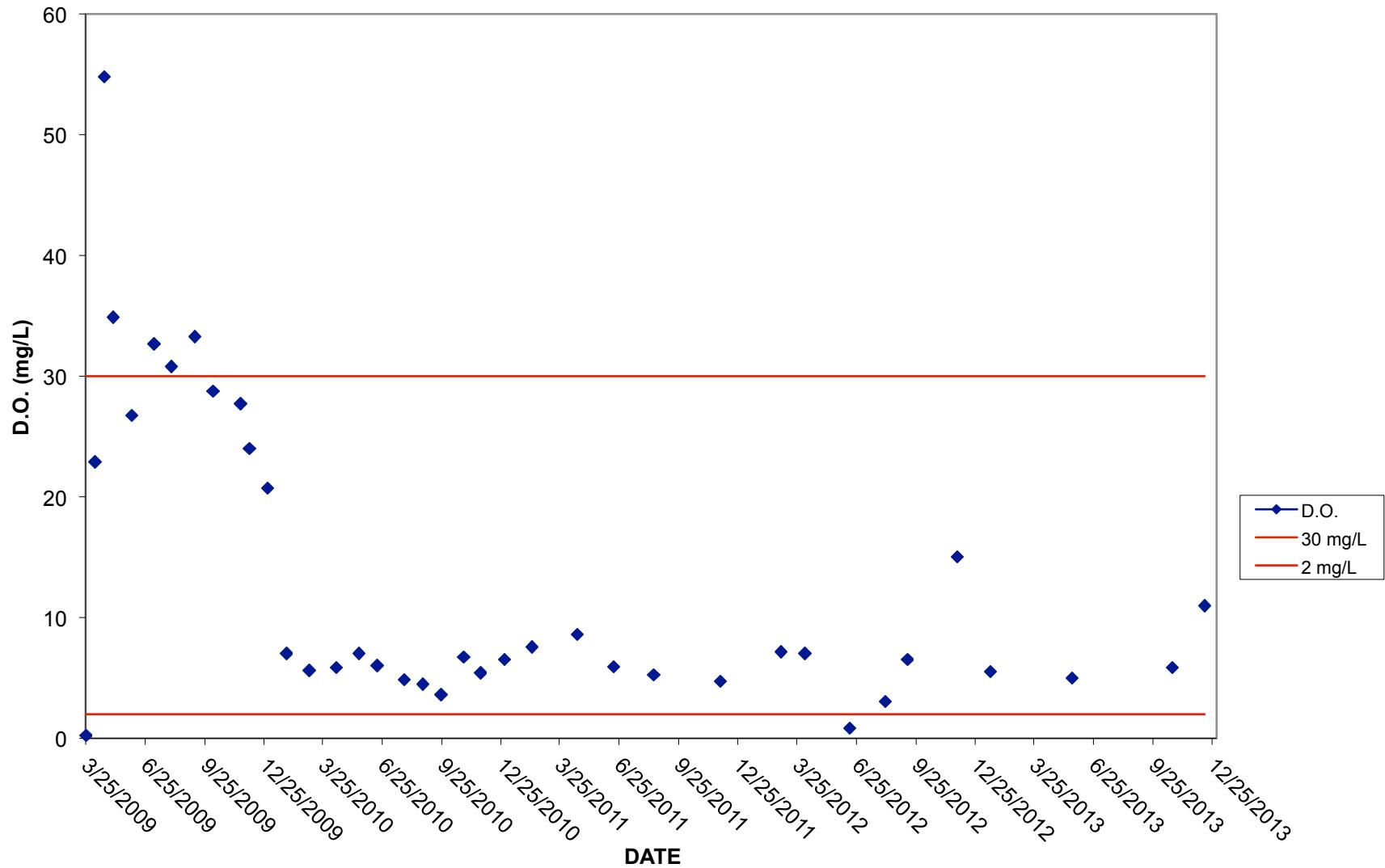
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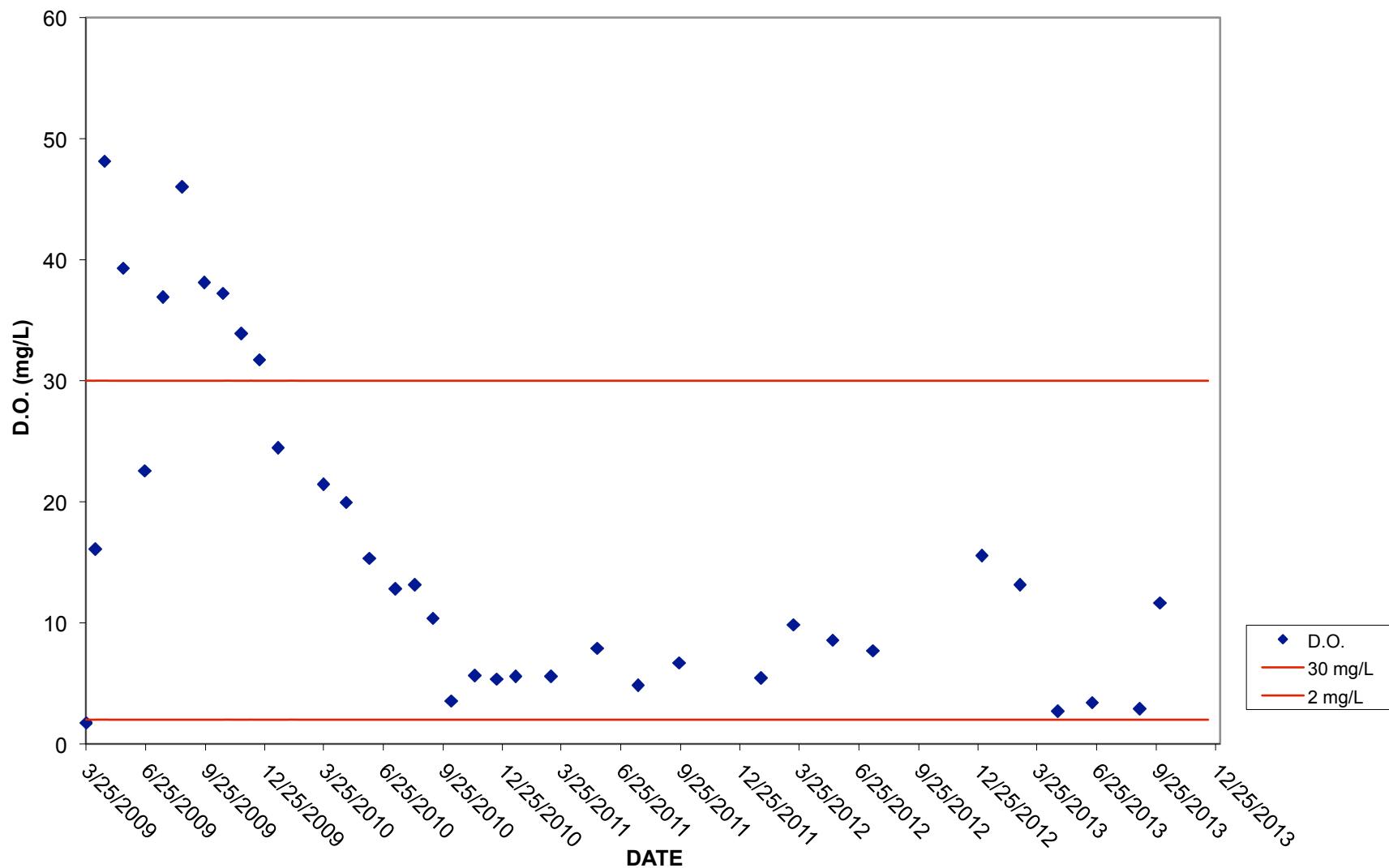
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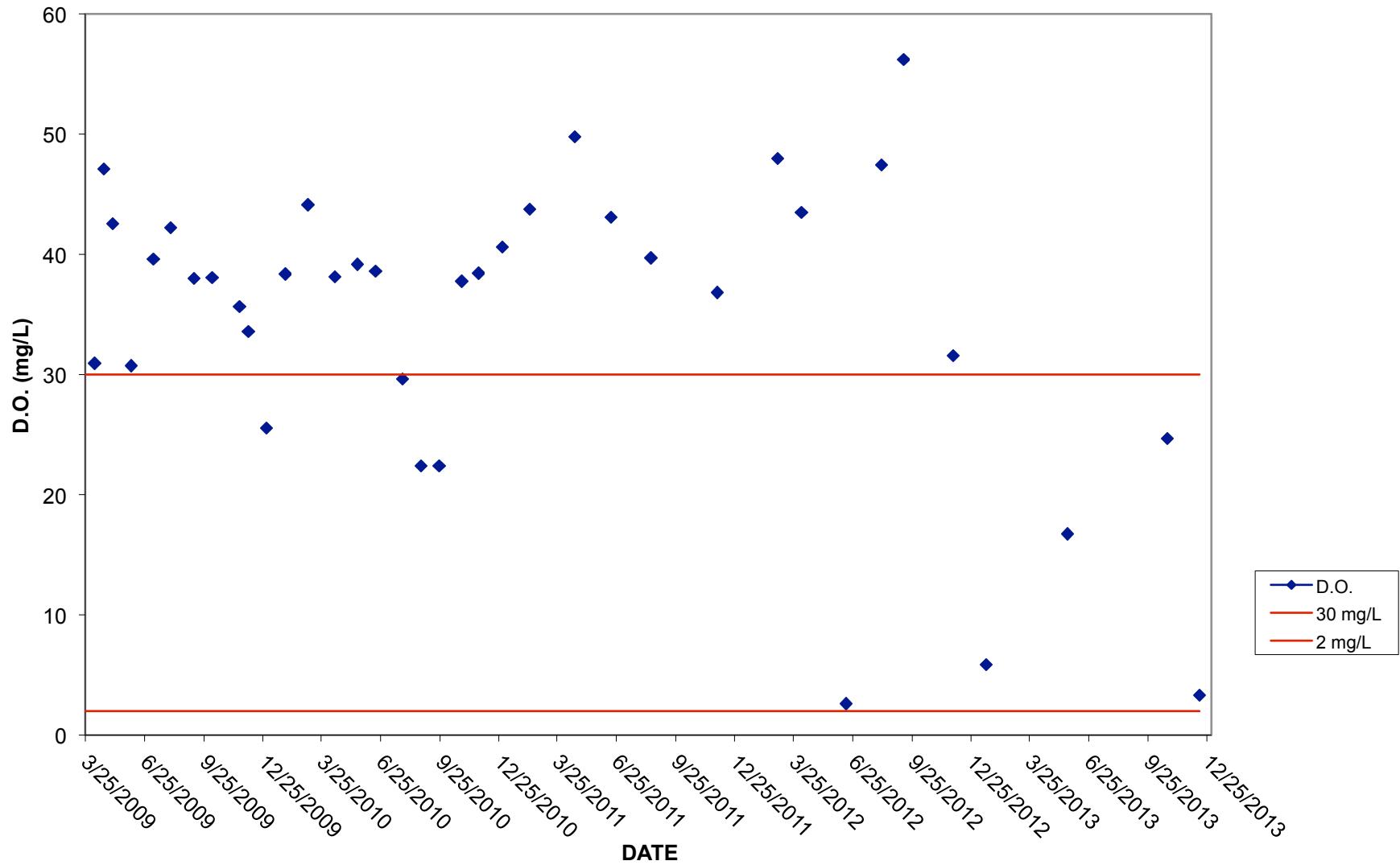
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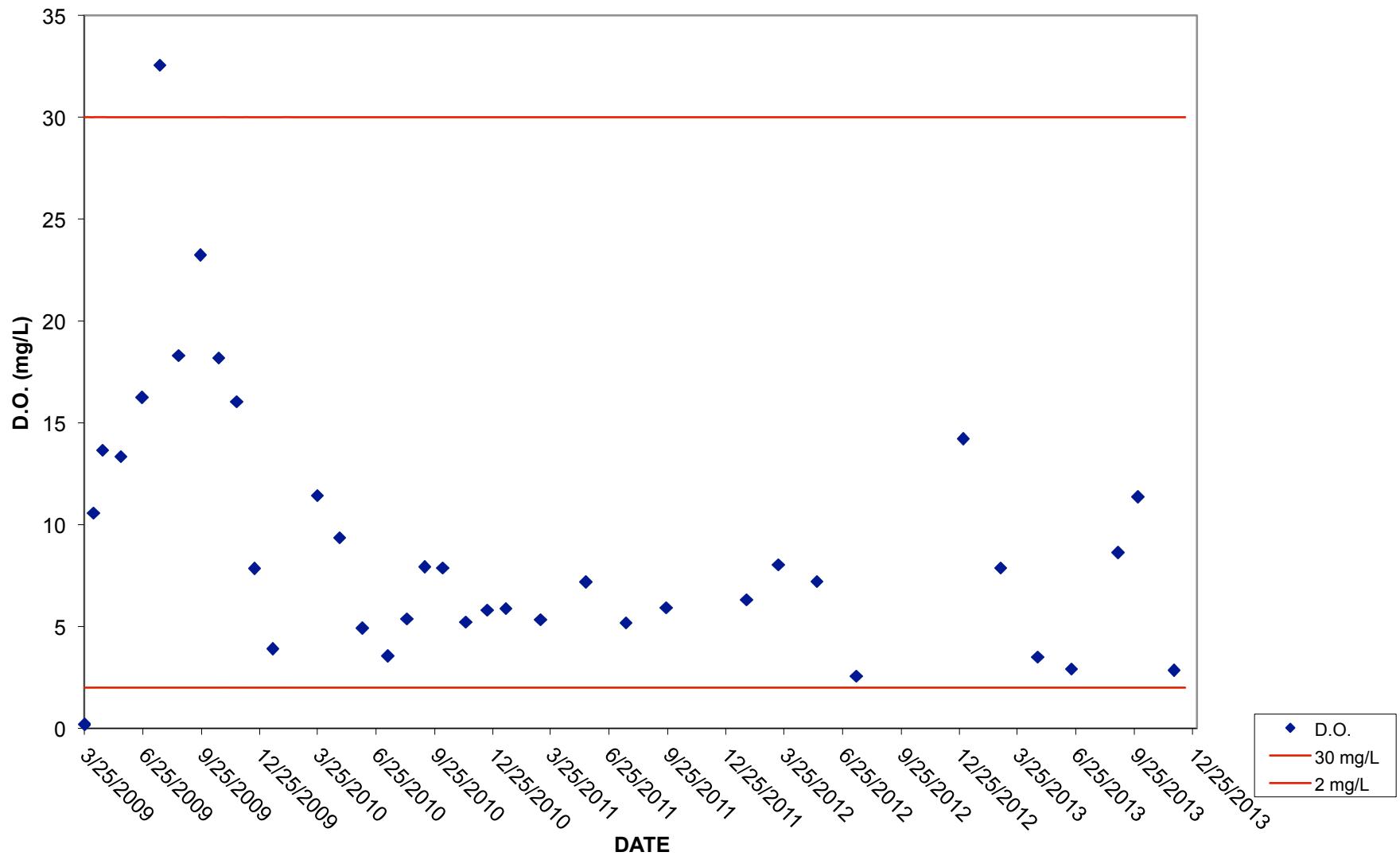
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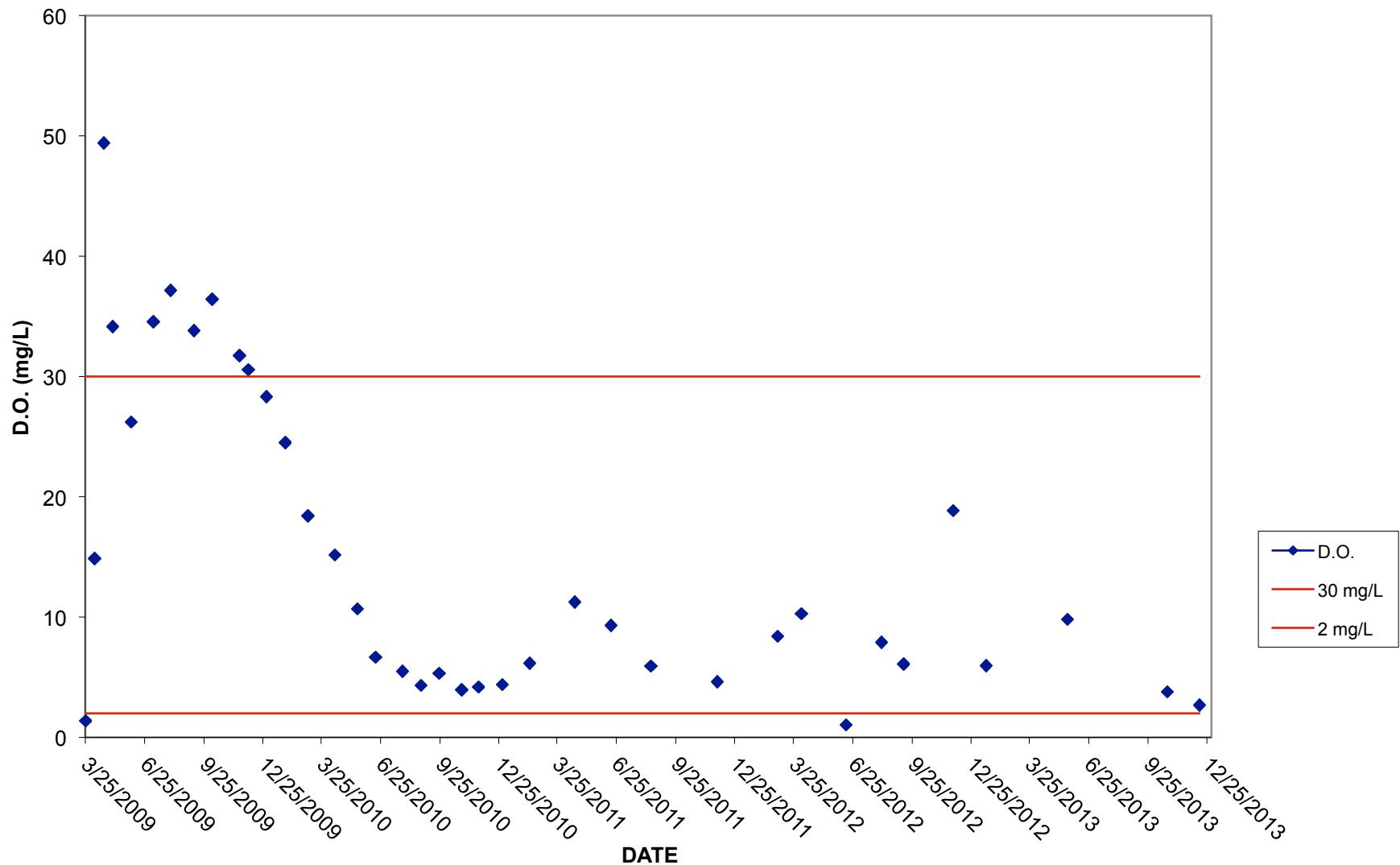
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### IW-26D D.O. FIELD DATA vs TIME



### IW-27D D.O. FIELD DATA vs TIME

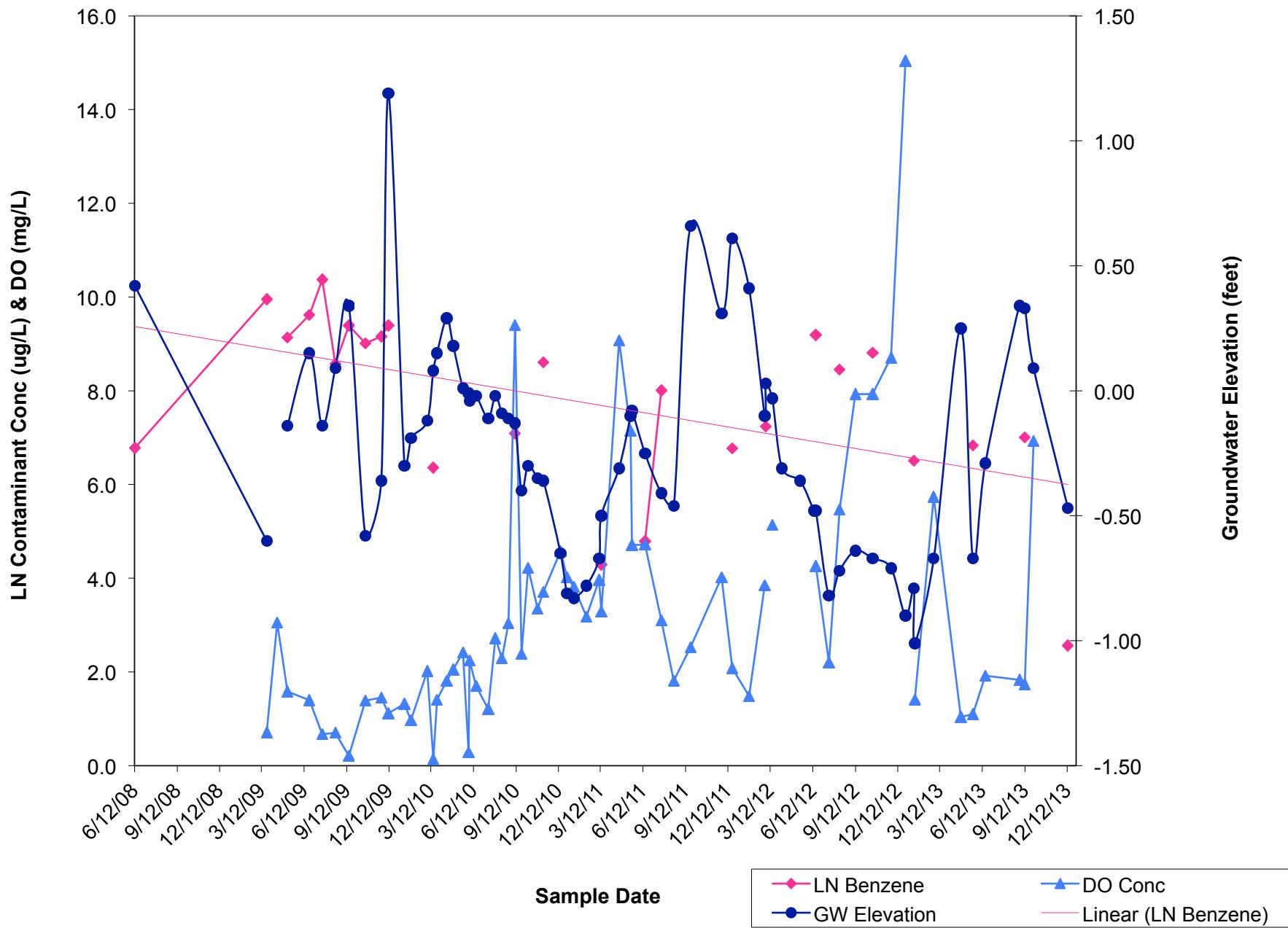




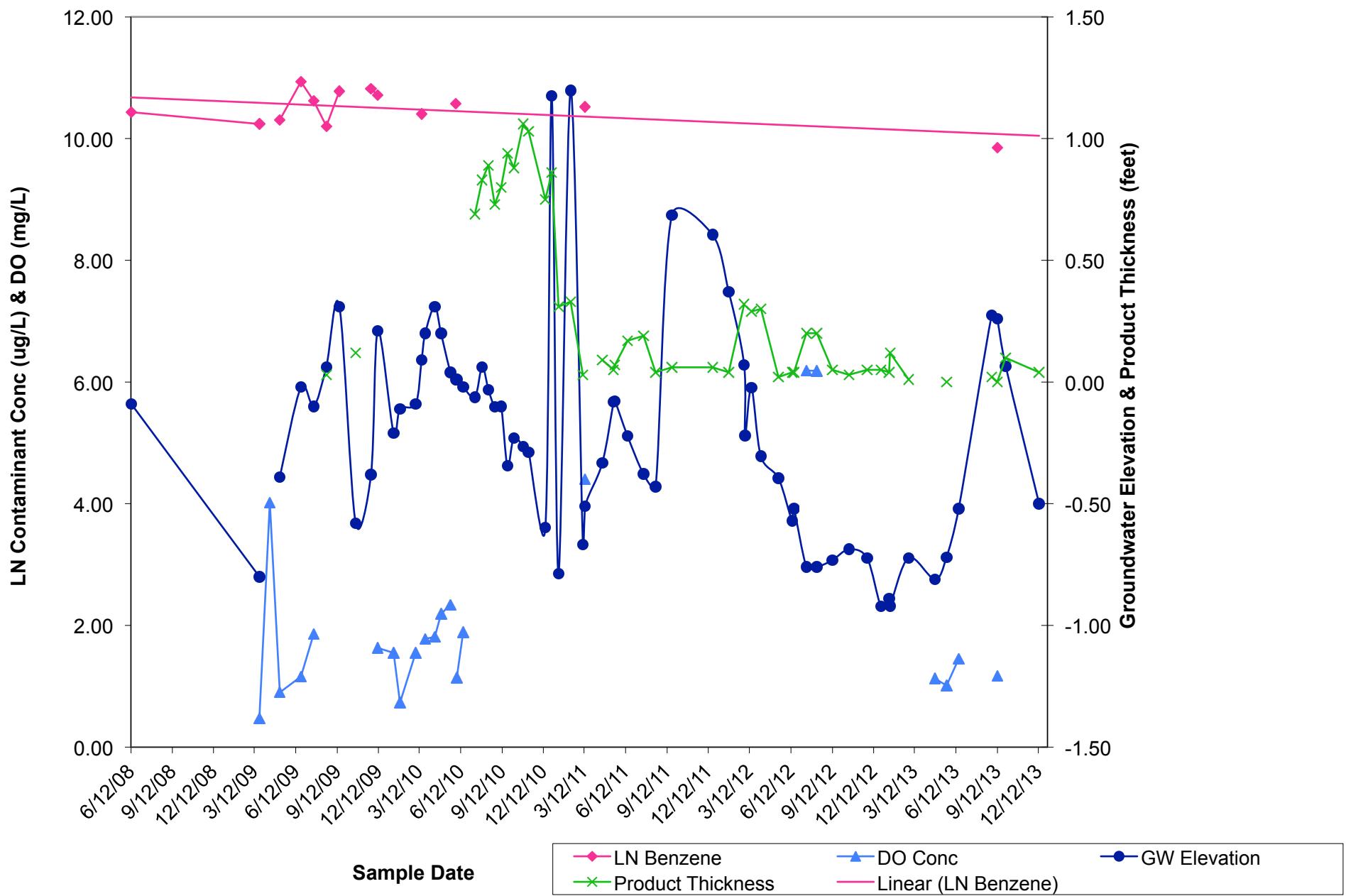
## **ATTACHMENT C**

### **DO, Benzene and Groundwater Elevation vs Time Graphs**

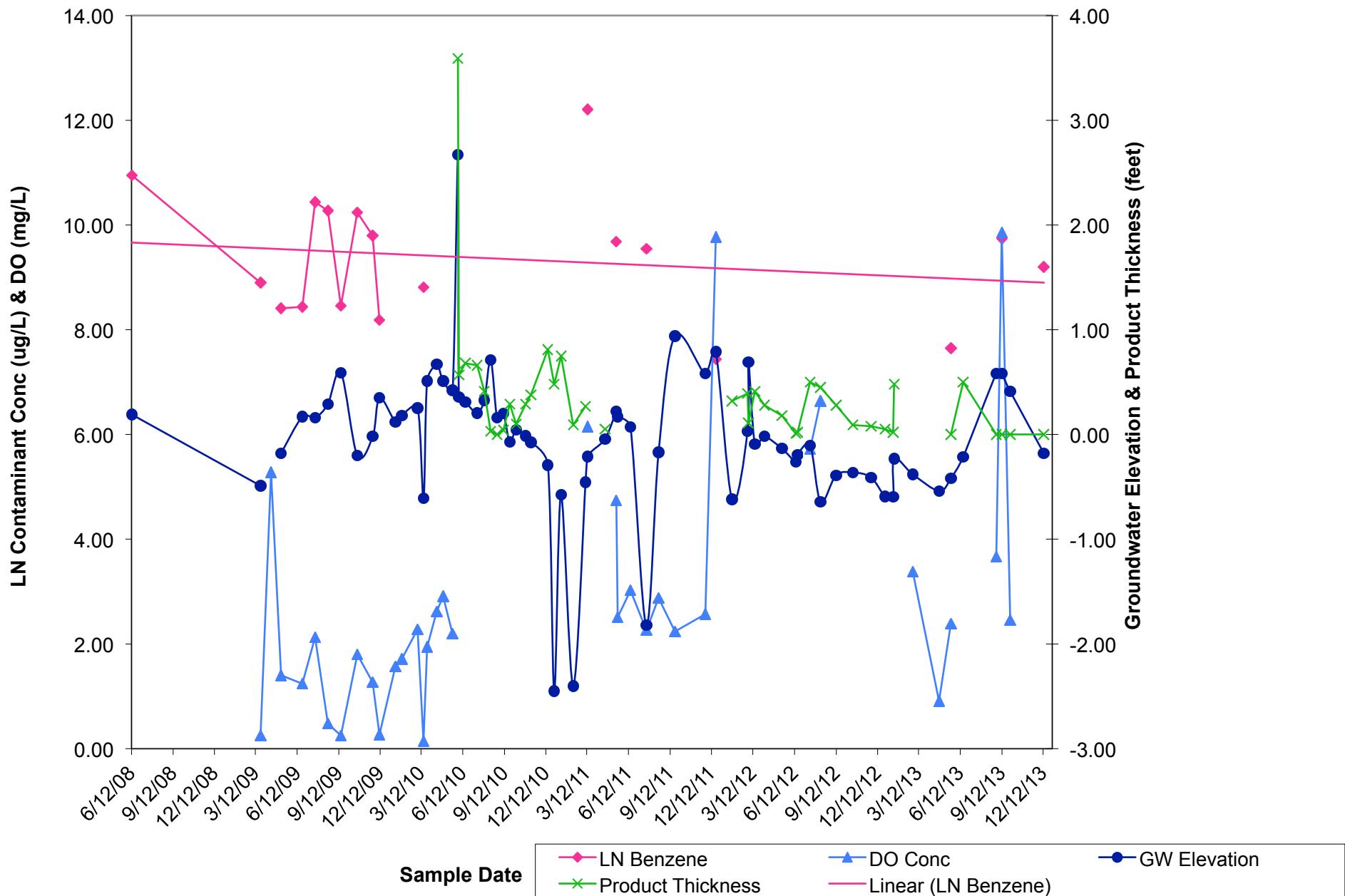
## S-50



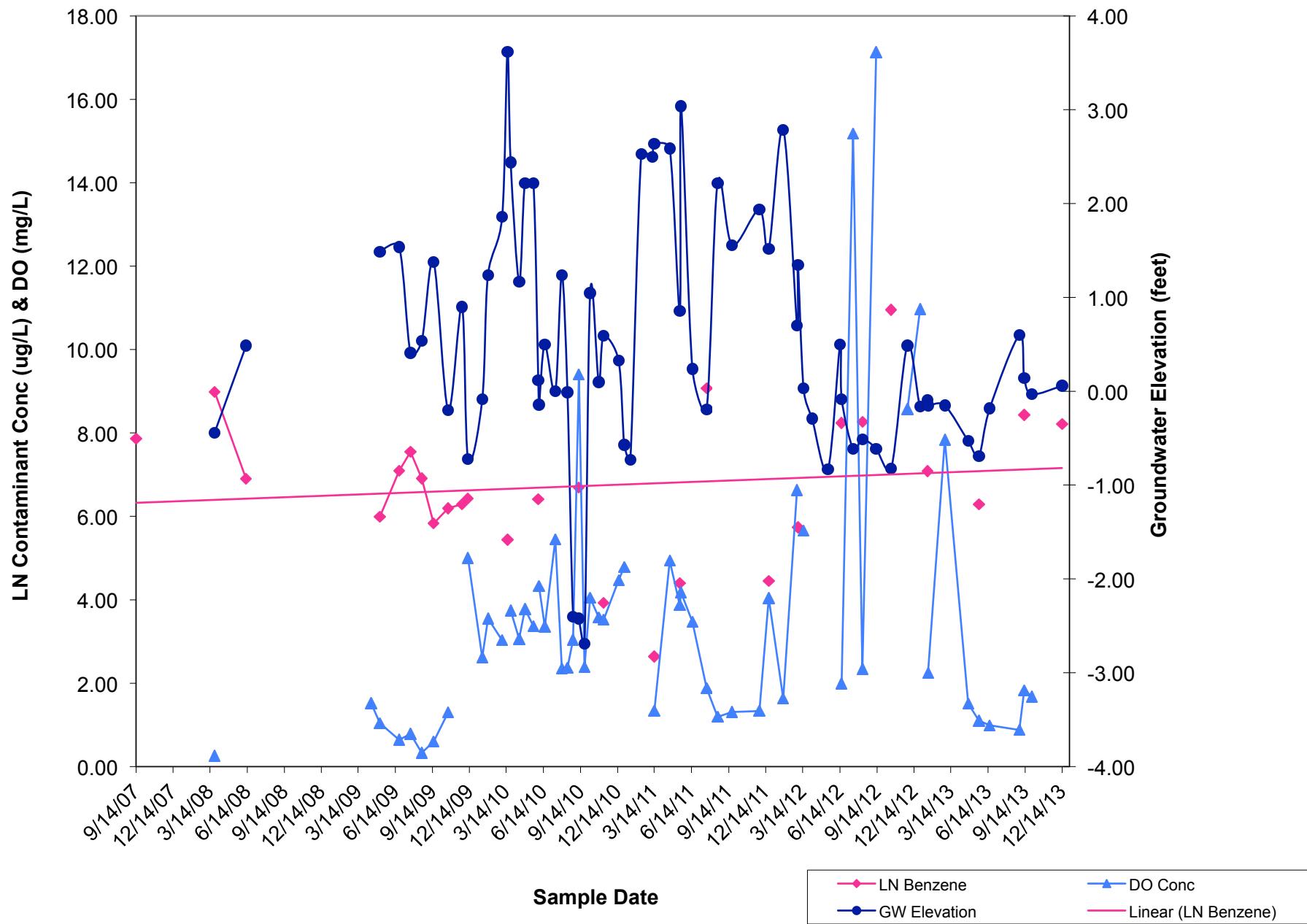
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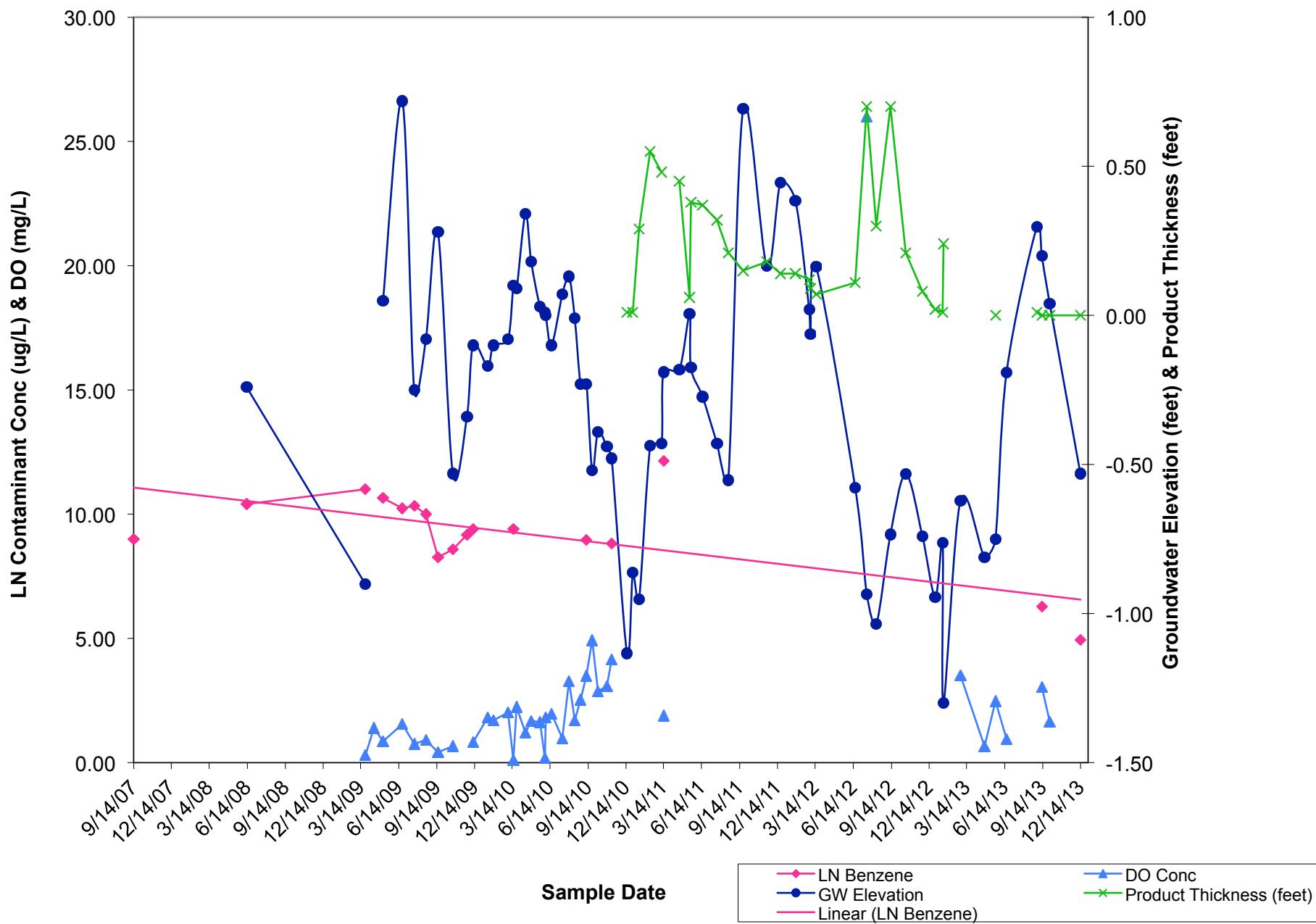
## S-226



## S-230



S-231



S-232

